

TALK ABOUT STUFFS & THINGS:

The Logic of Mass & Count Nouns

by

Kathrin Koslicki

Submitted to the Department of Linguistics and Philosophy
in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

at the Massachusetts Institute of Technology
May 1995

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ABSTRACT:

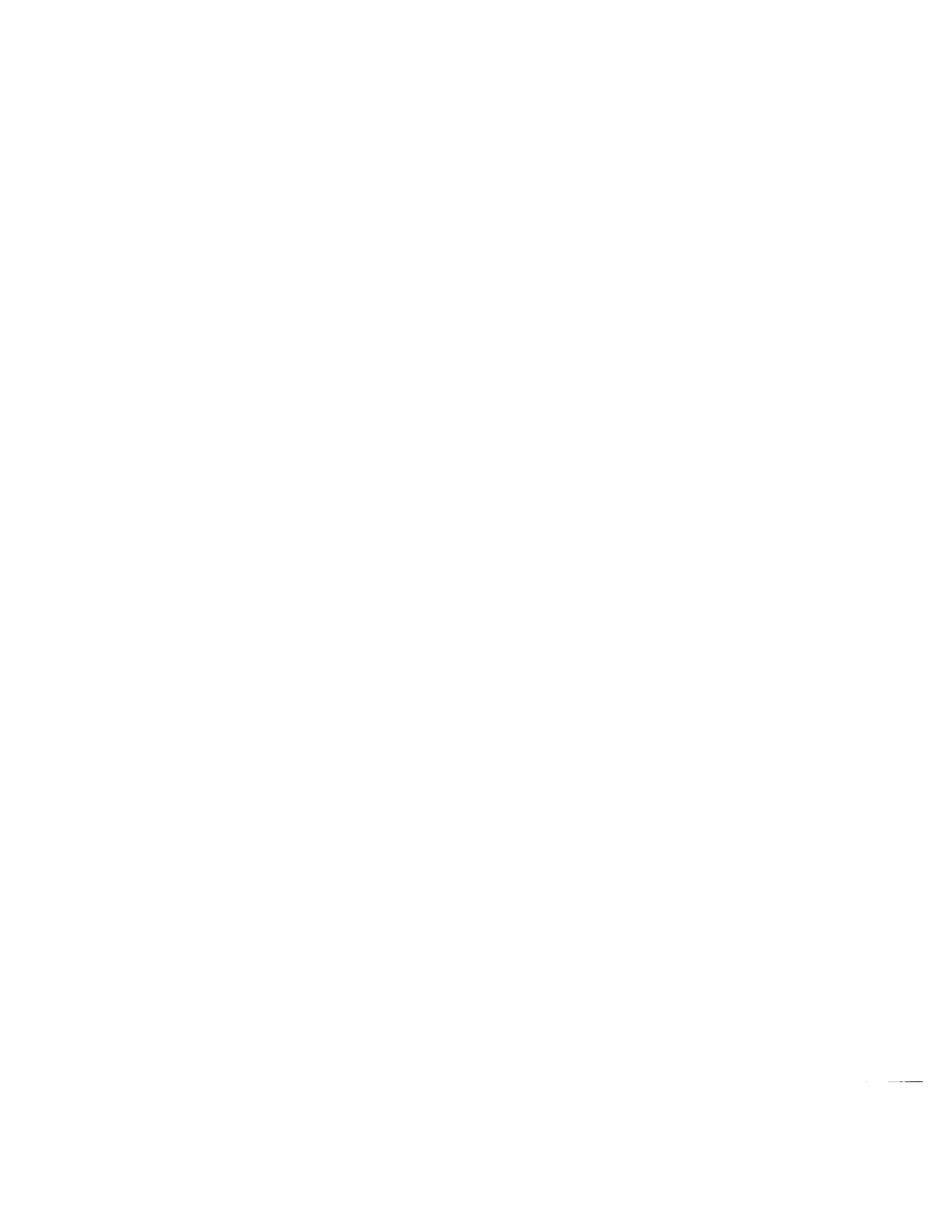
My thesis examines the mass/count distinction; that is, to illustrate, the distinction between the role of "hair" in (i) "There is hair in my soup" and (ii) "There is *a* hair in my soup". In (i), "hair" has a *mass-occurrence*; in (ii), a (singular) *count-occurrence*. These two kinds of noun-occurrences, I argue, can be marked off from each other largely on syntactic grounds.

Along the semantic dimension, I suggest that, in order to account for the intuitive distinction between nouns in their mass-occurrences and their singular count-occurrences, there must be a difference between the semantic role each of them plays. From among the available options, the most attractive one is to analyze nouns in their mass-occurrences as *predicates*. But, traditionally, nouns in their singular count-occurrences are also analyzed as predicates. I propose, therefore, that there are two different kinds of predicates: mass-predicates, such as "is-hair", and singular count-predicates, such as "is-a-hair". Neither kind is reducible to the other. This takes some getting used to: we are quite accustomed to dealing with singular count-predicates; but the notion of a mass-predicate is commonly considered somewhat mysterious. We therefore often come across attempts to reduce mass-predicates like "is-hair" to singular count-predicates of the form "is-a-quantity-of-hair" and the like. However, upon closer consideration, such attempts at reduction are not only unnecessary but also unhelpful.

Mass-predicates and singular count-predicates have something in common: they are both *predicates*. That is, they are related to their extension in the same way, viz. they are both *true of* whatever falls in their extension and the relation "is-true-of" at play here is, I conjecture, the same in both cases. The two kinds of predicates are also related to each other in a certain way, namely through a one-way entailment relation going from count to mass: everything that is *a* hair is also hair, but not conversely. And, finally, there are certain truth-conditional differences between them: the singular count-predicate "is-a-hair" is true only of whole individual hairs; the mass-predicate "is-hair" is true of individual hairs as well as hair-sums and hair-parts.

These truth-conditional differences turn out to have interesting implications, in particular having to do with the part/whole relation and the act of counting. It is often held

that mass-predicates are, as part of their meaning, *homogeneous*, while singular count-predicates are said to lack this property, as part of their meaning. (A predicate is homogeneous just in case it is *distributive*, i.e. true of all *parts* of something of which it is true, and *cumulative*, i.e. true of all *sums* of something of which it is true.) I suggest, instead, that at least distributivity has to be rejected as a semantic property of mass-predicates, on the grounds that, to pick a representative example, water is not infinitely divisible into parts that are themselves water. The second kind of implication, having to do with the act of counting, is as follows. When we wish to associate, say, the world's hair with *cardinal number* (as this would be done in certain kinds of questions beginning with the words "how many"), we need to speak of it in terms of individual hairs, the things of which the singular count-predicate "is-a-hair" is true. If, on the other hand, we are interested in *amounts* of hair (as expressed, for instance, in certain kinds of questions beginning with the words "how much"), we need to speak of the world's hair in terms of those things of which the mass-predicate "is-hair" is true. However, we could be talking about the very same thing, e.g. the hair in my soup, in either a mass-way or a count-way, whichever one is more handy at the time. In other words, the way we talk need not reflect any difference in the kind of thing we are talking about (though it could).



Although I was tempted to wait for something more worthy, I would like to dedicate this thesis to my parents, Eleonore and Carl, from whom I have received nothing but unquestioning support for what, to them, must have seemed like a rather strange choice of career.

ACKNOWLEDGEMENTS

I would like to thank, first and foremost, my thesis supervisor, Judy Thomson. I barely remember what the world was like before I started working with her. I *seem* to remember that I already knew how to walk and make scrambled eggs; but that's about it. The first time I heard of the topic of mass nouns was when Richard Larson handed me Tyler Burge's paper "Truth & Mass Terms", in my senior year of college at SUNY Stony Brook. But I did not start to think seriously about mass nouns until Judy Thomson asked me to give a presentation on the topic in her metaphysics seminar in the spring of 1992. From then on she supervised my every step with the closest attention and constant encouragement. I also profited immensely from the other members of my committee: Dick Cartwright, Bob Stalnaker, and George Boolos. How they managed to get through the countless meetings they agreed to have with me over the years, when they must have been quite fed up with "There is hair in my soup" versus "There is *a* hair in my soup", is beyond me. I cannot begin to describe all the interesting ways in which they influenced my project. Next in line is Jason Stanley: undoubtedly, my philosophical mindset was deeply shaped by the seven years of conversations with him. Before I met him, I did not think it was possible for regular people like me to become academics. And, without him, I would never have ended up in this strange but wonderful country. (His brother Marcus, along with the rest of the family, also turned out to be a great resource.) I hasten to mention the members of my Greek reading group at Harvard, from which I have derived great pleasure and a wealth of obscure adjectives: Gisela Striker, Mitzi Lee, Dana Miller, Mark Schiefsky, and Carl Pierson (as well as all the former and one-time members). I received numerous helpful suggestions from the following people (who, I hope, will forgive me for being listed alphabetically): Brian Beakley, Sylvain Bromberger, Alex Byrne, Susan Carey, Josh Cohen, Diana Cresti, Martin Davies, Tim Dilligan, Michael Glanzberg, Delia Graff, Ned Hall, Richard Heck, Irene Heim, Jim Higginbotham, Paul Horwich, Shawn Kern, Angelika Kratzer, Tom Kuhn, Utpal Lahiri, Richard Larson, Peter Ludlow, Friederike Moltmann, Graham Oddie (even though he was one of my interviewers at the Boston APA), Ian Rumfitt, Barry Schein, Gabriel Segal, Daniel Stoljar, Zoltan Szabo, Jamie Tappenden, Brian Ulicny, and Timothy Williamson. I would like to express my gratitude to the audience at the second Harvard/MIT graduate student conference, in the fall of 1993, where I presented material from chapter 4 of this thesis. Finally, I am extremely indebted to Helen Morris Cartwright: her groundbreaking work, more than anyone's, has deeply influenced my own thinking on the topic of mass nouns. I do not know whether she would agree with me, but I consider this thesis very much in her spirit.

TALK ABOUT STUFFS & THINGS:

The Logic of Mass & Count Nouns

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I. INTRODUCTION

There seems to be an intuitive distinction between the role of "hair" and "salt" in:

- (1) a. There is a hair in my soup.
b. There is salt in my soup.

"Hair" in (1.a) is said to play the role of a *count noun*; "salt" in (1.b), on the other hand, is said to function as a *mass noun*. Most of the literature on the so-called mass/count distinction is concerned with the differences between these two roles a noun can play.¹

However, the felt distinction between the roles of "hair" and "salt" in (1.a) & (1.b) is not a distinction between two classes of *nouns*. Rather, as I argue in chapter III., it is a distinction between *occurrences* of nouns. Consider, for example, the occurrences of "hair" in:

- (1) a. There is a hair in my soup.
c. There is hair in my soup.

In (1.c), "hair" has a *mass-occurrence*. This occurrence of "hair" is of the same kind as that of "salt" in (1.b), in the relevant respects. In contrast, the occurrence of "hair" in (1.a) is a *count occurrence*. The mass/count distinction is a distinction between these two kinds of occurrences.²

¹ Attempts have been made to extend the mass/count distinction to syntactic categories other than nouns and noun-phrases. However, I shall have relatively little to say about these other syntactic categories.

² Another way to characterize the distinction between (1.a) & (1.c) would be to say that it results from a *lexical ambiguity*. The lexicon, according to this view, contains two different entries for "hair": the mass-noun "hair" and the count-noun "hair". This approach, however, seems to me to be misguided. We should take seriously the intuition that it is in fact *one and the same* noun occurring in both (1.a) & (1.c). The noun "hair" plays two different roles in its two occurrences, but there is a systematic relation between its mass-occurrence in (1.c) and its count-occurrence in (1.a). The lexical-ambiguity approach does not preserve the intuition that it is one and the same noun occurring in both (1.a) & (1.c). According to this approach, (1.a) & (1.c) contain two *different* nouns which only happen to be pronounced the same.

Since, on my view, the mass/count distinction is a distinction between occurrences of nouns, we will, first of all, need an answer to the following group of questions. How can we tell, for any given occurrence of a noun, whether it is a mass-occurrence or a count-occurrence? What other contexts are such that an occurrence of "hair" in these contexts qualifies as a mass or a count-occurrence? In what respects is the occurrence of "hair" in (1.c) like that of "salt" in (1.b)? What are the criteria by which we classify these occurrences of nouns? In short, to get a clearer picture of the distinction suggested by the contrast between (1.a) & (1.b), we will, first of all, need an answer to the following group of questions:

(i) CLASSIFICATION:

- * Which occurrences of nouns are mass-occurrences?
- * Which occurrences of nouns are count-occurrences?
- * How are mass-occurrences of nouns marked off from count-occurrences of nouns?

These questions and the project of classifying occurrences will be dealt with in chapter

III. For now, let me simply list two groups of nouns: the ones in the first group standardly have mass-occurrences; those in the second group standardly have count-occurrences:

(M) Gold, water, sugar, salt, coffee, snow, mud, macaroni-and-cheese, metal, fluid, ham, tea, ink, footwear, blood, bacon, furniture, cricket, tennis, phosphorus, alcohol, sunlight, flour, malaria, music, poetry, vagueness, nonsense, anger, freedom, etc.

(C) River, person, circle, book, molecule, machine, thunderstorm, meal, shoe, bottle, puddle, building, planet, school, word, square, line, number, definition, contract, deal, performance, etc.

On the basis of what has been said so far, it is hard to see what the organizing principle or principles of these two groups of nouns could be. What, one might wonder, do "gold" and "common sense" have in common that makes it of interest to group them together into one list? What distinguishes "river" and "number" from "poetry" and "footwear", in virtue

of which the first two appear under (C), while the latter two are listed under (M)? What are we to think of the dual-role expressions, such as "hair", which seem to belong in both lists? How are the lists to be continued?

When I said earlier that there seems to be an intuitive distinction between the occurrences of "hair" and "salt" in (1.a) & (1.b), I was really referring to a whole bundle of facts, about which there is general, pretheoretic agreement. What makes the area of research surrounding the mass/count distinction so notoriously messy is precisely the diversity of facts on which it is founded. It is sometimes difficult to see what to make of these facts.

To give the reader a rough sense of what I have in mind and without going into the matter in any detail, the facts relevant to the mass/count distinction are, among others, facts about the difference between things and the stuff they are made of; facts about the difference between counting and measuring; facts about the identity-criteria of those entities to which nouns in their mass and count-occurrences, respectively, apply; facts about their criteria of individuation; facts about the distinction between subjects and predicates; facts about the different ways in which occurrences of expressions bear on their semantic values; and, finally, facts about pluralization and quantification. (There may be others which also belong here.) Why it should be difficult to see what to make of these facts will be the subject mainly of chapter IV., although we will run into some of them already on the way.

First, however, we shall want to understand why the so-called mass/count distinction is worth worrying about at all, or, at any rate, why a good many philosophers and linguists think it is. Most people's interest in this issue, it seems, originates from a concern, not so much with the classificatory project (i), but rather with the following group of questions:

(ii) LOGICAL FORM:

- * What is the logical form of sentences containing count-occurrences of nouns?
- * What is the logical form of sentences containing mass-occurrences of nouns?

The interest in Project (ii), in turn, originates from a concern with the more general project of stating the logical form of natural language sentences.

The first half of (ii), the question what is the logical form of sentences containing count-occurrences of nouns, is not generally perceived as particularly troublesome, at least as long as the nouns in question have singular, rather than plural, count-occurrences. A sentence like "Socrates is a man" is thought to be true just in case the predicate "is-a-man" is true of the subject Socrates; that is, just in case Socrates is one of the items in the extension of the predicate "is-a-man".

Stating the logical form of natural language sentences is considerably less straightforward in the case of mass-occurrences of nouns. While there is relatively widespread agreement that nouns in their singular count-occurrences should be treated as functioning semantically as part of a predicate, it is much less obvious which semantic category mass-occurrences belong to. Do they play the role of a name? Of part of a predicate? Do they play both roles? As we shall see, the difficulty with nouns in their mass-occurrences is that some of their properties would intuitively make us class them with names, while others point in the direction of predicates. Nouns in their mass-occurrences seem to fall in between names and predicates.

The *semantic* enterprise of stating the logical form of natural language sentences, in particular those containing mass occurrences of nouns, also gives rise to certain *metaphysical* questions. If a particular semantic account has posited a certain kind of entity as the denotation of nouns in their mass-occurrences, something will have to be said by way of

explaining the nature of these entities. What are their criteria of individuation and identity? Are they abstract, can we locate them spatio-temporally, or are they neither abstract nor spatio-temporally locatable? And so on.

One might of course hold the view, as some do, that metaphysical questions concerning the nature of the entities posited lie outside the responsibilities of a semantic theory. This line, however, does not (and is presumably not intended to) deprive the metaphysical enterprise of its legitimacy. It merely suggests that the semantic enterprise is separate from the metaphysical one. Hence, somebody engaged in one of the two enterprises, on this view, would not immediately be forced to commit himself to any particular position concerning the second.

In chapter II., I consider three early proposals about the semantic and the metaphysical issues raised in connection with Project (ii), beginning with Quine's.³ Since the analysis offered in Word & Object constitutes what might be regarded as the first serious proposal in the literature about such issues, it has set the stage for much of what followed. We shall see that there are actually two different readings of Quine. The two other proposals I discuss, that of Parsons (1970) and that of Burge (1972), certainly remain well within the space of possible solutions, as it was first envisioned by Quine. The treatment offered in Parsons (1970) is actually quite similar to one of Quine's proposals. Burge (1972), on the other hand, raises several objections to both Quine and Parsons. However, as far as fundamental matters, such as the nature of predication, are concerned, Burge is quite content to accept an essentially Quinean position.

In chapter III., I first offer some evidence for the claim I made at the beginning of this chapter, namely that the so-called mass/count distinction is really a distinction between

³ Word & Object, sects. 19 & 20, pp.90-100.

occurrences of expressions, rather than expressions themselves. I then turn to Project (i), the project of classifying occurrences of nouns into mass-occurrences and count-occurrences. It seems as though Project (i) can be dealt with on purely syntactic grounds. There may be exceptions, but syntax certainly goes a long way.

Chapter IV. is concerned with the Problem of Logical Form (Project (ii)), in particular as it pertains to mass-occurrences of nouns. I argue that nouns in their mass-occurrences are to be analyzed as functioning semantically as part of a *predicate*. More specifically, a noun in a mass-occurrence functions as part of a *mass-predicate*. A noun in a singular count-occurrence, on the other hand, functions as part of a *singular count-predicate*. Mass-predicates and singular count-predicates, I shall argue, are irreducibly different kinds of predicates. In the rest of chapter IV., I take a closer look at these two kinds of predicates. It turns out that there are interesting differences between them, having to do with parthood and counting. But they also have something in common: both kinds of predicates are *predicates*; that is, they are related to their extension in the same way. And, finally, they are related to one another through a one-way entailment relation going from count to mass.

II. SOME EARLIER PROPOSALS

1. Quine: Like many other writers on the subject, Quine is driven by worries about how to analyze sentences containing mass-occurrences of nouns. Of course, like nearly everyone else, he phrases his discussion in terms of classes of nouns, rather than certain of their occurrences. Nevertheless, I shall speak, hopefully without distorting his views, as though Quine was concerned with the logical form of sentences containing *mass-occurrences* of nouns. (Similarly, in the case of Parsons and Burge.)

Quine's worry results from the following intuition. Consider the sentences in (2)-(7):

- (2) That puddle is water.
- (3) The white part is sugar.
- (4) The rest of the cargo is furniture.

- (5) Water is a fluid.
- (6) Sugar is sweet.
- (7) Furniture is often made of wood.

Intuitively, "water", "sugar" and "furniture" have mass-occurrences in all of these sentences. Nevertheless, the underlined nouns in the first group seem to be playing a different role from those in the second. "Water", "sugar" and "furniture", as they occur in (2)-(4), seem to function as part of the predicate expressions "is-water", "is-sugar", and "is-furniture". Their occurrences in (5)-(7), on the other hand, have a distinctive name-like flavor.

Quine begins by drawing attention to a distinction between *singular terms* and *general terms*. The distinction is based on two kinds of observations: observations of a syntactic kind and observations of a semantic kind.⁴

⁴ How these two kinds of considerations connect (if indeed they connect at all) will come up later on, in section III.

First, general terms are said to be *syntactically* distinct from singular terms in the following respects. Any expression which occurs in such contexts as "the...", "the same...", "that...", "another...", and the like, is functioning as a general term. Expressions which play the role of a singular term, on the other hand, cannot occur in any of these contexts. Proper names, for instance, which standardly function as singular terms, sound odd in any of the following contexts: "a John", "the John", "that John", "the same John", etc. In addition, any expression which has a plural occurrence is functioning as a general term. Expressions which function as singular terms do not accept pluralization (e.g. "Johns").⁵

Second, turning now to Quine's *semantic* considerations, terms are classified into singular and general according to their role with respect to predication. Expressions which are playing the role of a singular term, if they have a referent, refer to objects; if they lack a referent, they at least purport to refer to an object. Expressions which function as general terms, on the other hand, are either true or false of the objects to which singular terms refer.

Given Quine's characterization, to which category should mass-occurrences of nouns be assigned? Are nouns in their mass-occurrences playing the role of singular terms or that of general terms? In some respects, nouns in their mass-occurrences seem to behave more like singular terms. "Water", which standardly has mass-occurrences, sounds odd in some of the contexts characteristic of general terms, e.g. "a water", "another water", and "waters". However, "water" can occur in the contexts "the water", "that water", and "the same water". Moreover, paradigm singular terms, such as "John", in Quine's view, never occur after the copula. But, as illustrated in (2), "water" can do so quite naturally.

⁵ This is not completely right. Proper names *can* have plural occurrences, as in "Several Johns came to the party". Perhaps, these plural occurrences will ultimately be analyzed away, along the lines of "Several people named 'John' came to the party", but their existence should nevertheless be acknowledged.

Quine's response is to assign mass-occurrences a double life of sorts:

...[T]he mass term is found to enter predication sometimes after "is", like a general term in adjectival form, and sometimes before "is", like a singular term. The simplest plan seems to be to treat it accordingly: as a *general term* in its occurrence *after* "is", and as a *singular term* in its occurrences *before* "is".⁶

Thus, Quine's central thesis is the following:

QUINE'S DUAL ROLE ANALYSIS:

- (8) When a noun has a mass-occurrence and precedes the copula, it plays the role of a *singular term*.⁷
- (9) When a noun has a mass-occurrence and follows the copula, it plays the role of a *general term*.

Applying Quine's proposal to the two groups of sentences we met at the beginning of this section, we thus get the *same* logical form for both groups of sentences (ignoring the internal structure of the subject expression in (2)-(4)):

- (10) Fa.

The crucial contrast, then, between (2)-(4) & (5)-(7) lies in the fact that the mass-occurrences in the *first* group are represented in (10) as the *general term* "F", while those in the *second* group appear in the role of the *singular term* "a".

⁶ Word & Object, p.97; my emphasis. As it stands, this view surely cannot be right, because of examples like "Blood is in the sink". Quine must have some notion of preferred regimentation in mind, according to which sentences can be *brought into* the required form.

⁷ For reasons which will become apparent shortly, clause (8) does not represent Quine's view with full accuracy. However, it will do for our present concerns.

Although Quine's dual-role analysis undoubtedly has a certain intuitive appeal, it gives rise to the following objection. As pointed out in Burge (1972), Quine will (at least on the face of it) have difficulties accounting for inferences of the following sort:

- (11) a. Snow is white.
b. This stuff is snow.

c. This stuff is white.

On Quine's view, "snow" performs two different semantic roles in its occurrences in (11.a) & (11.b). In (11.a), "snow" functions as a singular term; in (11.b), on the other hand, it functions as a general term. Thus, the Quinean representation of (11) would be

- (12) a. Wa
b. Sb

c. Wb

(where "W" is the predicate "is-white", "a" is the name "snow", "S" is the predicate "is-snow", and "b" is the name "this stuff"). As it stands, the Quinean construal of (11), as given in (12), makes an intuitively valid argument come out invalid. What Burge's objection suggests, I take it, is this: Quine's dual-role analysis emphasizes the difference between the predicative and non-predicative role of nouns in their mass-occurrences to a point where it becomes unrecognizable that we are in fact dealing with two occurrences of *one and the same* expression. Burge's inference only goes through on an analysis which reflects the fact that it is *the same* expression, viz. "snow", that occurs in both (11.a) & (11.b).

If we look more closely, however, there seems to be another reading of Quine, which bypasses Burge's objection (at least in conjunction with one other modification). As we have seen, nouns in their mass-occurrences, on Quine's view, can function as both singular and

general terms, depending on their location with respect to the copula. The second interpretation of Quine arises when we ask what nouns in their mass-occurrences, in their two different semantic roles, refer to or are true of.⁸

Quine thinks that nouns in their mass-occurrences *before* the copula refer to scattered objects, e.g. the totality of the world's water.⁹ But what is it that nouns in their mass-occurrences appearing *after* the copula are true of? Quine responds in the following way:

We can view the mass terms in these contexts [after the copula] as general terms, reading "is water", "is sugar", "is furniture" in effect as "is *a bit of* water", "is *a bit of* sugar", "is *a batch of* furniture". In general a mass term in predicative position may be viewed as a general term which is true of each portion of the stuff in question, excluding only the parts too small to count. Thus "water" and "sugar", in the role of general terms, are true of each part of the world's water or sugar, down to single molecules but not to atoms; and "furniture", in the role of general term, is true of each part of the world's furniture down to single chairs but not to legs and spindles.¹⁰

What Quine seems to be suggesting here is that nouns in their mass-occurrences, when appearing after the copula, are in fact *elliptical* for more complex expressions involving certain appropriate relations, such as "is-a-bit-of" or "is-a-batch-of".

As it stands, Quine's response leaves a number of questions open. For instance, which relations are appropriate for which nouns? Could there be a systematic, formal treatment which selects the right relation in each case? What are we to make of the "excluding only the

⁸ Nouns in their mass-occurrences, when they play the role of a general term, contrast with those functioning as singular terms not only in *what* they refer to (are true of), but also in the *way* in which they refer. However, this contrast shall not become relevant until we turn to Burge, toward the end of section II.

⁹ Quine dismisses any worries concerning the nature of scattered objects by saying:

Even the tightest object, short of an elementary particle, has a scattered substructure when the facts are in. [Ib. p.98.]

¹⁰ Ib. p.98; my emphasis.

parts that are too small" condition? Should a semantic theory tell us when a part of some entity is too small? And so forth.¹¹

A more important difficulty for present purposes is that an analysis of the type Quine suggests seems to imply that the name-like role of nouns in their mass-occurrences, is, in some sense, basic. On this second reading, Quine has in effect abandoned his earlier dual-role framework. We are now dealing with a *single-role* analysis: the single role being the name-like role of nouns in their mass-occurrences. Predicative mass-occurrences of nouns are interpreted roughly as "is-a-bit/batch/portion/...-of ___", where the noun filling the blank refers to the *same* entity as its counterpart in subject position. "Is-a-bit-of-water" really means *is a bit of the totality of the world's water*, i.e. the scattered object.

Quine's new proposal leaves us with the following two rules of interpretation for nouns in their mass-occurrences:

QUINE'S SINGLE-ROLE ANALYSIS:

(13) When M has a mass-occurrence and plays the role of a *singular term*, it refers to the totality of the world's m.

(14) When M has a mass-occurrence and plays the role of a *general term*, it is true of what is denoted by the subject term iff what is denoted by the subject term is something that Ψ the totality of the world's m.

(13) & (14) are schemata and they are to be understood as follows. Replace "M" by the name of any noun, "m" by the noun itself. " Ψ " is replaceable by whatever relation turns out to be appropriate in a given context, e.g. "is-a-bit-of", "is-a-batch-of", etc. What relation is appropriate in a given context depends, among other things, on the particular noun in question. (Quine unfortunately does not offer a procedure for pairing mass-occurrences of nouns with

¹¹ Some of these questions will be taken up again in section IV. See also e.g. Cartwright (1965), p.474ff; Moravcsik (1979), p.273 ff.

appropriate replacements for " Ψ ".) Thus, when the noun in question is "water", we may, for instance, replace " Ψ " by "is-a-puddle-of", "is-a-drop-of" and the like, but not by "is-a-heap-of". To illustrate, when we replace "M" by "'water'" and " Ψ " by "is-a-puddle-of", we get

(13) When "water" has a mass-occurrence and plays the role of a singular term, it refers to the totality of the world's water.

(14) When "water" has a mass-occurrence and plays the role of a general term, it is true of what is denoted by the subject term and what is denoted by the subject term is something that is a puddle of the totality of the world's water.

The new analysis, as stated in (13) & (14), differs from our previous reading of Quine, in that predicative mass-occurrences of nouns have now been, so to speak, unpacked. The result of unpacking, i.e. assigning a certain internal semantic structure to, mass-occurrences of nouns is that these occurrences are now analyzed in terms of the denotation of the singular-term mass-occurrence plus some appropriate Ψ -relation. (Clause (13) is the same on both readings.)

Before returning to Burge's inference, let's briefly apply the new analysis to our two initial groups of sentences, (2)-(7). For the first group, we now get a different logical form:

(15) $a\Psi b$.

("a", in (15), stands for "that puddle", "the white part" or "the rest of the cargo"; "b" stands for "water", "sugar" or "furniture", which respectively denote the totality of the world's water, sugar and furniture. " Ψ " is replaceable, for instance, by "is-a-bit-of", "is-a-batch-of", etc. Thus, sentence (2), for instance, now reads "That puddle is a bit of the totality of the world's water", assuming that "is-a-bit-of" is appropriate in this context).

The second group, sentences (5)-(7), on the other hand, would still be represented as

(10) Fa,

since rule (13) (which is the only rule relevant to an analysis of (2)-(4)) is common to both readings of Quine.

Now, how does Quine's proposal, on the second reading, avoid Burge's worry? From what has been said so far, (11), on the new proposal, would be represented as (16):

(16) a. Wa
b. bΨa

c. Wb

(where the second premise reads "This stuff is a bit of the totality of the world's snow"). As it stands, (16) is of course still invalid. However, to make (16) valid, Quine could adopt the following, quite plausible, move. He could re-analyze the first premise as involving implicit quantification over bits of snow. For simplicity, let's assume the quantification in question is universal. (16) would then become

(17) a. $\forall x [x\Psi a \rightarrow Wx]$
b. bΨa

c. Wb.

(The first premise of (17) reads "For any x, if x is a bit of the totality of the world's snow, then x is white".) In (17), we finally have a representation of Burge's argument which makes it come out valid. Note that (17) does not suggest a new, third, reading of Quine. All it implies is that not everything which, on the surface, appears to be functioning as a singular term is in fact functioning as a singular term. Hence, (17) does not violate Quine's dictum, according to which mass-occurrences of nouns before the copula are always to be analyzed as playing the role of singular terms. For Quine surely did not mean to extend his claim to

quantified sentences as well. Thus, (17) contradicts Quine's earlier view only in this respect: a sentence like "Snow is white" will now have to be viewed as implicitly quantificational.

But the re-construal proposed in (17) will not be called for in all cases. Not all sentences which look superficially like "Snow is white" (i.e. sentences in which an unquantified noun in subject-position has a mass-occurrence) need to be analyzed as implicitly quantificational. (18) is an example of an argument for which no such re-construal is called for:

- (18) a. Snow is cold and white.

 b. Snow is cold.

The inference from (18.a) to (18.b) follows even when we take "snow" to be naming the scattered object snow, as illustrated in (19):

- (19) a. Ca & Wa

 b. Ca.

We could, without any harm, read (18) as quantifying over bits of snow, as in (20):

- (20) a. $\forall x [x\Psi a \rightarrow (Cx \& Wx)]$

 b. $\forall x [x\Psi a \rightarrow Cx]$.

But nothing forces us to do so, since (19) already captures the validity of the inference in (18).

However, not all cases are as harmless as (18). For some sentences which superficially resemble "Snow is white" the re-construal in (17) will not even be permissible. Some sentences in which a noun in subject-position has a mass-occurrence *cannot* be re-analyzed straightforwardly as implicitly quantificational. Consider, for example, (21):

(21) Water covers two-thirds of the earth's surface.

Presumably, (22) would not be a viable representation of (21):

(22) $\forall x [x\Psi_a \rightarrow Cx]$

(where "C" stands for "covers two-thirds of the earth's surface"). It is simply not true of every bit of water that *it* covers two-thirds of the earth's surface. Only the totality of the world's water taken together covers two-thirds of the earth's surface. There is a whole group of predicates that are like "covers-two-thirds-of-the-earth's-surface" in this respect, e.g. "is-rare", "is-spread-out", "is-scattered-around", "is-extinct", "is-scarce", etc.¹²

Generally, the step in (17) is *required* in the case of inferences that involve going from totalities to the bits making them up. The inference in (11), for instance, states a property of the totality of the world's snow and then asserts that a particular instance of this totality has the same property. The step in (17) is *permissible* only where the predicate in question is of the kind shared by totalities as well as the bits making them up. "Covers-two-thirds-of-the-earth's-surface" is an example of a predicate that generally only applies to totalities and not to the bits making them up.

¹² Actually, (21) raises some very interesting questions as to what Quine means by "world" (when it occurs in his phrase "totality of the world's"). If he means the entire universe, then (21) is clearly false. Even there is no water anywhere else in the universe (or was or will be?), we presumably would not want to read (21) as "Every bit of the totality of the *universe's* water covers the earth's surface". Intuitively, the sentence does not say anything about the entire universe; it only says something about this planet. Moreover, even if we are to read "world" as this planet, (21) still comes out false. It is true that the water contained in the world's bodies of water (i.e. oceans, lakes, rivers and the like) covers two-thirds of the earth's surface. But there are more bits of water around than what is contained in the world's bodies of water, e.g. the water in human bodies and other animals. So all the bits of water taken together would cover more than two-thirds of the earth's surface. But can we plausibly read (21) as "The totality of what is contained in this planet's oceans, rivers and lakes covers two-thirds of the earth's surface"?

In summary, we have seen that there are two readings of Quine, the dual-role account and the single-role account. According to the dual-role account, nouns that have mass-occurrences can function either as singular terms or as general terms, depending on their position with respect to the copula. The dual-role analysis, as it stands, has difficulties accounting for the Burge-inference in (11), because it does not capture the fact that we have one and the same expression occurring in two different semantic roles. We arrive at the single-role account by unpacking the general term "is water" into the singular term denoting the totality of the world's water plus an appropriate reference-dividing relation, e.g. "is-a-*puddle-of*". The single-role analysis can capture the Burge-inference in (11), by re-analyzing the first premise "Snow is white" as implicit quantificational, where the quantification in question is over bits of the totality of the world's snow. However, as we shall see in this next section, the single-role analysis will also run into serious difficulties involving Quine's Ψ -relation.

2. **Parsons:** Terence Parsons, in "An Analysis of Mass Terms & Amount Terms", reads Quine in the first of the two ways: he reads Quine as advancing a dual-role analysis, according to which nouns in their mass-occurrences can play the role of both singular terms and general terms, depending on whether they appear before or after the copula. Parsons himself takes up one of the two directions suggested by Quine's dual-role analysis. Let Φ be a variable (ranging over linguistic objects), then

PARSONS' SINGLE-ROLE ANALYSIS:

(18) For any noun Φ , sentences containing mass-occurrences of Φ are analyzable uniformly into some sentence containing a name of a substance, related to Φ in the right sort of way.¹³

For example, any mass-occurrence of "gold" is to be analyzed, depending on the context in question, either as itself a name for the substance gold or as part of a more complex expression containing a name for the substance gold. Thus, Parsons's position is actually quite similar to the second reading of Quine, the single-role analysis, according to which name-like mass-occurrences of nouns are basic and all others are to be analyzed in terms of them.

Let's first return to our familiar Burge-inference and see how Parsons' analysis accounts for its validity. The inference in question was

- (11) a. Snow is white.
b. This stuff is snow.

c. This stuff is white.

On Parsons' view, (11) receives the following representation:

- (19) a. $\forall x [xQa \rightarrow Wx]$
b. bQa

c. $Wb,$

¹³ What I mean by "related in the right sort of way" is the following. Suppose the noun in question is "gold", then the substance in question would have to be the substance gold, and not the substance water or snow. What it means for a substance to be related to a mass-occurrence of a noun "in the right sort of way" would of course need to be spelled out in more detail. Parsons himself does not consider this point in great detail.

where "a" names the substance snow, Q is the relation "is-a-quantity-of", "W" abbreviates the predicate "is-white" and "b" names this stuff. (19) has the advantage of preserving the intuitive validity of (11).¹⁴

On the basis of what has been said so far, we have no way of distinguishing (19) from Quine's possible way out, as stated in (17). As far as (19) is concerned, the only change Parsons introduces involves the relation Q which holds between totalities, such as the substance gold, and particular instances of a given totality. On Quine's account, this job was done by what I have called the Ψ -relation. The Ψ -relation was seen to be context-dependent in character, in that Ψ is to be replaced by different relations of the sort "is-a-batch-of", "is-a-bit-of", and the like, in different contexts. Thus, an expression of the form "a Ψ b", when viewed in isolation, really has no one interpretation. Its interpretation will differ from context to context, depending in part on the particular occasion at hand and on the kind of scattered object "b" names.

Parsons' Q-relation, on the other hand, at least superficially, lacks the context-sensitive quality of Quine's Ψ -relation. "aQb" *always* reads "a is-a-quantity-of b", regardless of the

¹⁴ One possible objection to (17) (as well as (19)) is that "Snow is white" does not strictly speaking mean *all quantities of snow are white*. If anything, it is a generic statement, to the effect that quantities of snow are *generally* white. For, given the fact that it is merely a generic truth about snow that it is white, we might become doubtful of the validity of (11). It does not follow from the fact that quantities of snow are *generally* white that *this* particular bit of snow is white. Generic statements differ from universal quantifications precisely in that the former allow for exceptions, whereas the latter do not. (See Cartwright (1975), p.40ff for further discussion.)

(11) also has another reading, on which it does come out valid:

- (20) Snow is white.
- This stuff = the totality of the world's snow
-
- This stuff is white.

But, although valid, (20) does not seem to be the reading Parsons, Burge and others have in mind in their discussion of (11).

particular substance named by "b" and the particular context at hand. But this might in the end amount only to a minor difference. Perhaps, "is-a-quantity-of" is in fact nothing more than a technical notion under which relations of the sort "is-a-bit-of", "is-a-batch-of", and the like are to be subsumed.

So far, there is thus only a minor difference, if any, between Parsons' proposal and the second reading of Quine. What really separates the two are certain of their *metaphysical* convictions. Semantically, they are quite close to each other, since both propose a single-role analysis, according to which nouns in their mass-occurrences play the role of a name. To bring out how these metaphysical assumptions make themselves felt semantically, we need to look at other examples. For none of them are relevant to the formalization of (11). Consider now the following sentence as an example that does illustrate where Parsons and Quine diverge:

(20) Muddy water is widespread.

We have already seen that, on Quine's view, nouns that have a mass-occurrence and precede the copula are to be analyzed as playing the role of names. When a noun functions in this way, it is said to refer to a scattered object. In the case of (20), "muddy water", according to Quine, names the totality of the world's muddy water, or, as we might say, the *mereological sum* of the world's bits of muddy water. (20) thus becomes

(21) $W(\iota y(\forall x[x < y \leftrightarrow (x \Psi w \ \& \ Mx)])$

(where "<" stands for "is-a-part-of" and " ι " is the iota-operator). (21) reads "The fusion of all bits of the world's water that are muddy is widespread". As (21) illustrates, Quine is not committed to anything over and above particular bits of muddy water and their fusions, i.e.

scattered objects. This is true of Quine in general, not just with respect to the sentences we have so far considered.

Parsons, on the other hand, would analyze (20) in the following way:

(22) $W(\sigma x[Mx \ \& \ xQw])$,

where " σ " stands for what Parsons calls a "substance-abstraction operator". (22) reads "The substance which consists of quantities of water that are muddy is widespread". We might think that Parsons' " σ "-operator is simply another way of expressing the notion of a mereological sum, in which case (21) & (22) would turn out to be equivalent. And in some respects, Parsons' substances are not too different from Quine's scattered objects. Parsons' substances are also scattered around the universe in the form of particular bits of matter. On Parsons' view, wherever a particular substance "occurs", there will be a bit of matter such that that bit of matter is a quantity of the substance in question. Thus, the substance gold, we might say, is scattered around the universe in the form of particular bits of matter which are themselves quantities of gold.

But Parsons' substances differ from Quine's scattered objects in one crucial respect. Presumably, Quine would consider two scattered objects which consist of the very same bits of matter to be identical. For Parsons, on the other hand, this is not the case. Parsons' substances are not the mereological sums of their material constituents. On his view, two substances could coincide spatio-temporally in every respect without thereby being identical.

His motivation for keeping substances and their material constituents apart in this way seems to originate from the following intuition. If the totality of the world's salt were piled up in a single room r , then m , the matter in room r , would spatio-temporally coincide with s , the substance salt. Yet not every quantity of m is also a quantity of s . Single sodium ions,

for instance, would count as quantities of *m*, but not as quantities of *s*. Thus, *m* and *s* should not be allowed to be identical. In fact, no two substances are identical, unless everything that is a quantity of the first is also a quantity of the second.¹⁵

The substance-abstraction operator, in addition to simple names of substances, is introduced because of complex names of substances, such as the "muddy water" of sentence (20). While simple substances, such as water, can be represented semantically by means of constants, complex names, such as "muddy water", require some way of attributing a certain property, such as that of being muddy, to a substance. What might appear to be the most natural way of saying that something is both water and muddy, " $\exists(x) [Is\text{-}water(x) \ \& \ Is\text{-}muddy(x)]$ ", is of course ruled out by Parsons' theory, according to which nouns in their mass-occurrences play the role of names rather than that of parts of predicates. Instead, Parsons offers us the (closed) singular term " $\sigma x[Mx \ \& \ xQw]$ ", meaning the substance all quantities of which are quantities of water that also have the property of being muddy.¹⁶

¹⁵ Parsons (1970), p.376 ff. Parsons is frequently interpreted as regarding substances as abstract entities. Parsons (1979), however, explicitly denies this interpretation:

The only consideration that might tempt one to conclude that the theory entails the abstractness of substances is the argument I gave to the effect that two different substances may occupy exactly the same space without being identical. But this by no means entails that they are abstract entities, and it certainly doesn't entail that they do not occupy space at all. [p.167]

¹⁶ The metaphysical differences between Parsons and Quine might also make themselves felt semantically in other respects. For instance, in addition to the "substance-abstraction operator", Parsons also introduces a constitution-relation, *C*. On Parsons' view, a sentence like

(23) My ring is gold,

for instance, would be represented as

(24) $\exists x [xCr \ \& \ xQg]$

Perhaps the most worrisome feature in Parsons' analysis is his Q-relation. Parsons takes this relation to be a primitive notion of his system. By way of an intuitive explanation of the notion *is-a-quantity-of*, Parsons says:

A substance, like gold, is found scattered around the universe in various places. Wherever it "occurs" we will have a bit of matter which *is a quantity of* gold. This somewhat vaguely delimits the extension of the relation "is-a-quantity-of". Another such delimitation is the following: if it is true to say of an object (a physical object) that it "is-gold", then the matter making it up will *be a quantity of* gold.¹⁷

The way to tell whether a particular bit of matter is a quantity of gold is to see whether the *predicate* "is-gold" is true of the object in question. The meaning of the relation "is-a-quantity-of" is thus explained in terms of the predicative use of nouns in their mass-occurrences. We might put this point as follows:

$$(26) xQs \leftrightarrow Sy,$$

where *s* is replaceable by names of substances, such as "gold", and *S* by the corresponding predicate, such as "is-gold". To illustrate, if *s* is replaced by "gold" and *S* by the predicate "is-gold", (26) asserts that a bit of matter *x* is a quantity of gold iff the predicate "is-gold" is true of the object constituted by the particular bit of matter. (26) gives the meaning of the primitive Q-relation. But (26) suggests that we must already intuitively understand the predicate "is-gold", if we are to grasp the meaning of "is-a-quantity-of-gold". If we do not

where "r" and "g" are names for my ring and the substance gold, respectively. Quine, on the other hand, might wish to analyze (23) simply in terms of parthood and the Ψ -relation, as in

$$(25) \forall x[x < r \rightarrow x \Psi g].$$

¹⁷ Parsons (1970), p.367.

already have a handle on predicative mass-occurrences, the Q-relation will certainly be of no help.

Now the trouble with (26) is that Parsons' analysis makes no room for predicates like "is-gold". For him, every mass-occurrence of a noun is to be analyzed either as itself a name of a substance or as a more complex expression containing names of substances and the Q-relation. The predicate "is-gold", on his view, is interpreted as "is-a-quantity-of-gold". For instance, a sentence like (27)

(27) Everything that is gold is valuable.

would be represented, not as

(28) $\forall x[Gx \rightarrow Vx]$,

where "is-gold" occurs as a genuine predicate, but as

(29) $\forall x[xQg \rightarrow Vx]$,

where "is-gold" is turned into "is-a-quantity-of-gold".¹⁸

For precisely this reason, Parsons is also barred from turning the Q-relation into a derived, as opposed to a primitive, notion. Since not all parts of gold are necessarily also quantities of gold, "is-a-quantity-of" cannot simply be collapsed into the more familiar parthood-relation, as suggested in the schema (30):

(30) $xQs \leftrightarrow x < s$

¹⁸ This objection against Parsons is raised in Burge (1972), p.270.

In order to make (30) acceptable, we would have to add the requirement that x still be a quantity of the substance in question, as shown in (31):

$$(31) xQs \leftrightarrow (x < s \ \& \ Sx)$$

Yet (31) would again require us to understand what it would mean for a mass-predicate to be true of something. This assumption, however, cannot be accommodated within Parsons' analysis. For " Sx " is itself interpreted as " xQs ".¹⁹

The same worry could also have been raised with respect to Quine's Ψ -relation. There may be slight differences between the two, but none of them will matter in the present context. What does it take to understand Quine's Ψ -relation? To tell whether x is a bit of water, we must know whether the predicate "is-water" is true of x . Thus, giving the meaning of Quine's Ψ -relation would involve the same appeal to genuine mass-predicates as Parsons' Q -relation did:

$$(32) x\Psi s \leftrightarrow Sx.$$

¹⁹ Parsons (1979) (a reply to criticisms of the earlier (1970) paper) seems to acknowledge this objection:

Were I to redo the paper now I would follow the majority and leave the predicate ["is-water"] unanalysed. This is not because I think that the way I originally did it is incorrect, but rather because analysing the predicate in the way that I did begs a philosophically controversial question concerning the identity conditions of substances. Specifically, I argued that two substances might coincide in space without thereby being identical. Burge correctly points out that in the case I imagined the proof that the two substances were not identical exploits the relational analysis of the predicate in question. I still think that two substances should be allowed to coincide in space without thereby being identical [...], but I don't believe that a *semantical* theory should legislate an answer to this question. [p.169]

But to leave the predicate "is-water" unanalyzed is to abandon a single-role analysis of the kind stated in (18), according to which the name-like role of nouns in their mass-occurrences is taken as basic.

But (32) gives rise to exactly the same difficulties as (26). Understanding the Ψ -relation requires a grasp of the predicative use of nouns in their mass-occurrences. But the second reading of Quine does not make room for genuine (unreduced) mass-predicates. For "is-gold" is taken to mean "is-a-bit-of-gold".

3. **Burge:** Burge (1972) lies at the other end of the spectrum. In contrast to both Parsons and Quine, Burge thinks that nouns in their mass-occurrences fundamentally (and uniformly) play the role of parts of predicates, rather than names. Burge's central thesis can be stated as follows. Let Φ be a variable ranging over nouns, then

BURGE'S SINGLE-ROLE ANALYSIS:

(33) For all nouns Φ , sentences containing mass-occurrences of Φ are uniformly analyzable into some sentence containing a predicate related to Φ in the right sort of way.²⁰

Burge thus takes up the second direction suggested by Quine's dual-role analysis.

A nice feature of Burge's approach is that our familiar argument (11)

- (11) a. Snow is white.
- b. This stuff is snow.
-
- c. This stuff is white.

can be represented in very simple terms:

- (34) a. $\forall x (\text{Snow}(x) \rightarrow \text{White}(x))$
- b. Snow (this stuff)
-

²⁰ Again, more would need to be said about the relation between a mass- occurrence of a noun and the predicate into which it is analyzed.

c. White (this stuff).

(34) is of course valid.

Burge assumes that we understand perfectly well what it means for the predicate "is-water" to be true of something. Now, this assumption might well be made sense of *if* one chose to adopt a view of general terms different from Quine's. But Burge does not do so. He follows Quine's characterization of general terms as having a "*built-in mode of dividing their reference*".²¹ What this means, for Quine (and, hence, for Burge as well), is that a competent speaker who has mastered the machinery of general terms will be able to tell, not only "how much of what goes on counts as apple", but also "how much counts as *an* apple, and how much as another".²² To have mastered the use of general terms is to be able to individuate, identify and contrast particular apples, as exemplified in the use of expressions like "an apple", "the apple", "that apple", "the same apple", "another apple" and "apples". For Quine, this is precisely what it means to have grasped "the scheme of enduring and recurrent physical objects".²³ In contrast, no such mastery of special devices is required for the use of singular terms: singular terms simply refer.²⁴

²¹ Word & Object, p.91. This is the feature of Quine's account hinted at in footnote 7.

²² *Ib.* p.91.

²³ *Ib.* p.92.

²⁴ In one sense mastery of divided reference *is* required for mastery of the use of singular terms. Quine would probably say that a speaker who has not yet mastered the use of general terms, also cannot have mastered the use of singular terms. Such a speaker would not understand the *contrast* between singular terms and general terms. When Quine imagines a child to use "apple" in the same way as the child uses "mother", he does not seem to want to suggest that the child has already mastered the use of singular terms, but not yet that of general terms. Rather, he seems to want to suggest that the child is using both "apple" and "mother" in the manner of what Strawson would call a "feature-placing" expression. When the child utters "apple", it must be interpreted as saying that there is some applehood around. In

For Quine's own analysis (at least on the second reading), this view of general terms as reference-dividers is not a problem. The reference of "gold" in a sentence like "This stuff is gold" is divided by means of a special reference-dividing device: the Ψ -relation. We understand "This stuff is gold", because we take it to mean *This stuff is a bit of gold*. (Of course, as we have just seen in connection with Parsons' Q-relation, there is a problem about grasping this reference-dividing relation without already having understood the predicative role of nouns in their mass-occurrences.)

On Burge's view, on the other hand, nouns in their mass-occurrences do not need the help of a special reference-dividing device. Nouns in their mass-occurrences by themselves --without the help of implicit relations like "is-a-bit-of", "is-a-piece-of", etc.-- are just as good at dividing their reference as their count-relatives. What this claim amounts to, in the end, is that there is no difference at all between count-occurrences and mass-occurrences of nouns. Mass-occurrences of nouns *are* count-occurrences in disguise. In other words, instead of saying "This stuff is gold", we could just as well say "This stuff is *a* gold". Of course, our current linguistic practice does not include expressions like "a gold" or "golds". And Burge grants that we do not standardly speak in this way. But we do not speak in this way, on his view, simply because we do not find it useful or convenient to do so.

In support of his view, Burge argues that natural language exhibits various devices of individuating, identifying and contrasting the semantic value of nouns in their mass-occurrences. The following two sentences, for instance, are perfectly intelligible to speakers of English:

this sense, mastery of the use of general terms, i.e. mastery of the scheme of divided reference, and mastery of the use of singular terms really go hand in hand. At the same time, singular terms themselves, according to Quine, do not divide their reference.

(35) This snow is not the same as that snow.

(36) The gold that now composes this earring is the same as the gold that lay in an irregularly shaped lump on the artist's table a month ago.

From the fact that we seem to have no trouble understanding sentences like (35) & (36), Burge concludes that we have a secure grip on what the individuation and identity criteria for the semantic value of nouns in their mass-occurrences are. Hence, so Burge seems to propose, there is no "deep" difference between mass and count-occurrences of nouns at all.

But Burge goes wrong in several respects. First, it is not obvious why the notion of predication should be linked up with that of countability in Burge's way. He seems to assume that whenever an expression is analyzed semantically as playing the role of part of a predicate, we must be able to individuate, identify and *count* the things it applies to. This conception of predication is no doubt one that is traditionally taken for granted. Quine, for one, would presumably be happy to accept this step from predication to countability. For him, mastering the use of general terms amounts to mastering the devices of individuation, identity and distinctness, i.e. the scheme of enduring physical objects. Once we have mastered these skills, so Quine seems to think, we have acquired all we need in order to be able to count things. What we would be counting, in the case of Quine, however, is not gold or snow, but bits, pieces, batches, etc. of gold and snow. "Gold" and "snow", in their mass-occurrences, do not themselves divide their reference; relations like "is-a-bit-of" do. And it is the reference-dividing relations which afford the machinery necessary for counting.

Still, as I shall discuss in more detail in chapter IV, there is no reason why the notion of predication *must* involve having a counting-procedure for the entities in question. This connection, although traditionally taken for granted, is an extra step; one that, in this case, comes with Quine's particular views concerning predication.

In this light, there is no need for Burge to view mass-occurrences of nouns as count-occurrences in disguise. The fact that speakers of English have the ability to understand sentences like (35) & (36) does not entail that they have a counting-procedure for the semantic value of "snow" and "gold", in their mass-occurrences. We can certainly understand expressions like "this snow" and "the same gold"; but this in no way establishes that we must be able to count snow or gold.

Now, Burge is right in one respect: nouns like "snow" or "gold", given the right set-up, *could* no doubt also have count-occurrences. (Again, more on this in chapter III.) Admittedly, given the way we presently speak and the way things are in this world, "snow" and "gold" standardly have mass-occurrences. But we can certainly imagine some kind of scientific "countification-procedure" of the kind Burge mentions, with the help of which we could make sense of an expression like "*a* gold" or "*a* snow". If it turned out to be convenient, science could legislate that any atom with atomic weight x is *a* gold. And, if a counting-procedure of this sort were to be established, nothing would stand in the way of counting gold or snow. What we would then be counting, however, are the semantic values of *count*-occurrences of "gold" and "snow". We still would not have a counting-procedure for the semantic values of their *mass*-occurrences. In fact, the whole idea of counting the denotations of nouns in their mass-occurrences is absurd.

Thus, the conceivability of Burge's "countification procedure" does not nothing to establish the claim that there is fundamentally no difference between mass-occurrences and count-occurrences of nouns. All it shows is that nouns which standardly have mass-occurrences could, given the right circumstances, *also* have count-occurrences. It does not mean that mass-occurrences are count-occurrences in disguise.

The reason why Burge cannot see it in this light, and this is the second respect in which he goes wrong, is that he considers the so-called mass/count distinction to be a distinction between expressions, rather than between occurrences of expressions. We began with the intuition that there was a distinction of some kind between mass-occurrences and count-occurrences of expressions. The fact that "gold" and "snow" could, under the right circumstances, also have count-occurrences should not persuade us to give up our original intuition that there is some intuitive distinction between mass-occurrences and count-occurrences of expressions.

4. Summary: To summarize, we have, up to this point, considered three proposals on the semantics and metaphysics of nouns in their mass-occurrences: Quine (1960), Parsons (1970) and Burge (1972). As it turned out, there are two different readings of Quine: the dual-role analysis and the single-role analysis. According to the dual-role analysis, nouns in their mass-occurrences can function either as names or as parts of predicates, depending on their position with respect to the copula. According to the single-role analysis, nouns in their mass-occurrences fundamentally play the role of names, to be supplemented by special reference-dividers when they appear after the copula. Parsons (1970) was seen to be very much in the spirit of Quine's single-role analysis, although there are certain metaphysical differences between the two. Burge (1972) takes up the other option: nouns in their mass-occurrences, on Burge's view, always function as parts of predicates, on a par with regular count-predicates. This option is already, in a way, foreshadowed by Quine's dual-role analysis (although this is not a view Quine himself adopts), in the sense that Quine draws our attention to two semantic categories --the category of names and the category of predicates-- as plausible candidates for the analysis of nouns in their mass-occurrences.

As we have seen, there is something wrong with all three of these proposals. Quine's dual-role analysis, as it stands, cannot account for the validity of simple inferences, such as (11). There are certain steps Quine could take to save his proposal, but it remains to be seen whether he would be met with further difficulties along the way.

Quine's single-role analysis makes crucial use of a problematic reference-dividing relation. Understanding the meaning of this relation requires more than Quine's account can accommodate. It requires us to know what it means for a genuine mass-predicate to be true of something. But Quine's account does not make room for genuine mass-predicates. The same objection applies to Parsons' single-role analysis.

Burge, in effect, proposes to give up completely on the distinction between mass-occurrences and singular count-occurrences of nouns. Since we began with the intuition that there is something to be captured in all of this, I consider this proposal to be unattractive. He is driven into the position he takes by accepting two faulty assumptions: first, the assumption that predication and countability must always go together and, second, the assumption that the so-called mass/count distinction is a distinction between expressions, rather than occurrences of expressions.

III. CLASSIFYING OCCURRENCES

1. Why Occurrences? I have only considered a few of the many analyses offered in the literature and, among them, I have focused on early proposals. Quine's initial worry about mass-occurrences of nouns was prompted by a general concern: to understand the referential work of language and to clarify our conceptual scheme --the conceptual scheme, that is, of physical objects, identity and divided reference. In recent years, I think it is fair to say, the tendency has been mostly in the direction of formal sophistication and, in a sense, away from the more fundamental philosophical issues. In this light, I propose that we now step back for a moment and re-consider where we stand.

I said at the outset that the so-called mass/count distinction is best thought of as a distinction between *occurrences* of expressions, rather than expressions themselves. Our initial intuition was that, for whatever reasons, "hair", in (1.a), has a mass-occurrence, while the occurrence of "hair" in (1.c) is a count-occurrence:

- (1) a. There is a hair in my soup.
c. There is hair in my soup.

The two groups of expressions I listed under (M) & (C) were meant to be lists of expressions which standardly have mass-occurrences (first group) and expressions which standardly have count-occurrences (second group):

(M) Gold, water, sugar, salt, coffee, snow, mud, macaroni-and-cheese, metal, fluid, ham, tea, ink, footwear, blood, bacon, furniture, cricket, tennis, phosphorus, alcohol, sunlight, flour, malaria, music, poetry, vagueness, nonsense, anger, freedom, etc.

(C) River, person, circle, book, molecule, machine, thunderstorm, meal, shoe, bottle, puddle, building, planet, school, word, square, line, number, definition, contract, deal, performance, etc.

The addition of "standardly" here is important. For, as has been pointed out quite frequently, almost any noun can have both mass-occurrences and count-occurrences (except apparently, as Sharvy (1978) & Ware (1975) point out, measure words like "glassful", "serving", "cupful", "ounce", "gallon", etc.), as long as we are willing to imagine the right sort of circumstance. Take "person", a paradigm example of a noun which standardly has count-occurrences. Now imagine a society in which the taboo on eating other people has been lifted. Suddenly, "person" can have mass-occurrences (as in "I'm starving, can you give me some more person, please?"), just like "chicken" and most of the other food-words.

It works just as well the other way around, from mass to count. Some of the nouns in (M) apply to things which already come in naturally packaged units (e.g. rice-grains in the case of "rice"). For others, conventional measures of amount have already been agreed upon (e.g. glasses, bottles, barrels and the like in the case of "beer"). In the case of those things for which no natural or conventional units have yet been recognized, we may simply think of the most convenient unit in each case, depending on what we do with the entity in question. "A money", for instance, could be either a single coin or a single bill.²⁵ "A gold" could be a clump of gold of a convenient size or, alternatively, a gold-atom, depending on the particular purpose at hand. Since vagueness may come either in single words (e.g. "bald"), in sentences or in thoughts (and perhaps elsewhere, too), "a vagueness" could be a vague word, a vague thought, a vague sentence, or all of them. Thus, not only could we introduce count-occurrences of nouns which have so far standardly had mass-occurrences into our vocabulary.

²⁵ I am talking here about *possible*, not actual, usage. We do not currently use the noun "money" in this way, but we certainly could. In fact, there are languages (e.g. Bavarian), where "a money" (meaning roughly an appropriate sum of money) is perfectly standard.

Given the right context, we could even understand sentences containing such non-standard occurrences *before* we have explicitly decided to enlarge our ways of speaking in this way. For instance, the sentence

(37) Boston has not had many snows lately.

is relatively easy to interpret. We would presumably understand "snows" as "snowfalls" or something along those lines, even if the utterer of (37) had not given us any prior hints that he would be using "snow" in this way.

Given all this, it seems fairly clear that we are dealing with occurrences of expressions, rather than expressions themselves. But, in that case, we had better first come up with a reliable procedure for telling mass-occurrences from count- occurrences. In other words, what is needed, at this point, is a set of criteria answering to the first group of questions I mentioned in chapter I.:

(i) CLASSIFICATION:

- * Which occurrences of nouns are mass-occurrences?
- * Which occurrences of nouns are count-occurrences?
- * How are mass-occurrences of nouns marked off from count-occurrences of nouns?

I also said that the intuitive distinction between the two occurrences of "hair" in (1.a) & (1.c) is based on a whole bundle of facts. I mentioned facts about the difference between things and the stuff they are made up of; facts about the difference between counting and measuring; facts about the identity-criteria of those entities to which nouns in their mass and count-occurrences, respectively, apply; facts about their criteria of individuation; facts about the distinction between subjects and predicates; facts about the different ways in which

occurrences of expressions bear on their semantic value; and, finally, facts about pluralization and quantification.

I shall divide these into three groups: *syntactic* facts, *semantic* facts, and *metaphysical* facts. Of course, a certain amount of overlap between these three groups is unavoidable. Not all of the relevant facts fall neatly under any one heading. Moreover, any serious attempt to group a bundle of facts into "syntactic", "semantic" and "metaphysical" would require a more general theory about the boundaries of each of these areas. I do not pretend to have such a theory. Thus, my groupings are to be thought of as nothing more than a convenient ordering device.

2. A Syntactic Approach to the Project of Classification: Let's first consider the syntactic material and see whether a purely syntactic approach to Project (i) is plausible. As it turns out, the syntactic criteria take us quite a long way. There are a few exceptions, where we need to appeal to semantic intuitions; but, by and large, a syntactic approach looks quite promising.

I begin with pluralization. As is well-known, the nouns listed under (M) do not pluralize easily. Consider the contrast between the following pairs of sentences:

- (38) a. *I bought wines for tonight's dinner.
b. I bought books for my library.
- (39) a. *There are enough coffees in my freezer to last for a while.
b. There are enough machines in this world to last forever.²⁶

²⁶ The star, in this case, is not supposed to indicate outright ungrammaticality. For, as sentence (37) was meant to show, nouns which standardly have mass-occurrences can, given the right circumstances, also have count-occurrences. When they do so, the result seems to be mere non-standardness, rather than outright ungrammaticality.

As (38) & (39) indicate, we seem to have an easier time pluralizing the nouns listed under (C), i.e. those which standardly have count-occurrences, than we do pluralizing nouns which standardly have mass-occurrences.

On the basis of these facts concerning pluralization, we might come up with the following rule of classification:

(R₁) A plural occurrence of a noun is a *count-occurrence*.

As a consequence of (R₁), any plural occurrence of a noun in list (M) will also be classified as a count-occurrence. For instance, the plural occurrence of "snow", in (37), is thus a count-occurrence of a noun which standardly has mass-occurrences. Similarly, the plural occurrences of "wine", "metal" and "mud" in (40.a)-(40.c) are all count-occurrences:

- (40) a. Which wines do you like best?
b. I would never use these metals for the work you're doing.
c. Certain muds are supposed to be good for your skin.

But this outcome should not bother us. Intuitively, "snows" in (37) applies to snowfalls. As the paraphrases in (41) illustrate, "wines", "metals" and "muds" in (40) can be read as applying to *kinds* of wine, metal and mud:

- (41) a. Which kinds of wine do you like best?
b. I would never use these kinds of metal for the work you're doing.
c. Certain kinds of mud are supposed to be good for your skin.

Turning now, second, to quantification, we observe that certain quantifiers, such as "much" and "little", standardly only combine with the nouns in (M):

- (42) a. Boston has not had much snow lately.
b. Boston has had little snow in the last few years.

- (43) a. *Boston has not had much thunderstorm lately.
 b. *Boston has had little thunderstorm in the last few years.

Others, such as the indefinite article "a", as well as "many" and "few", are standardly only found with the nouns in (C):

(44) *Boston has not had a snow lately.

(45) Boston has not had a thunderstorm in the last few years.

- (46) a. *Boston has not had many snow lately.
 b. *Boston has had few snow in the last few years.

- (47) a. Boston has not had many thunderstorms lately.
 b. Boston has had few thunderstorms in the last few years.

"Each", "every" and "several" as well as all numerical quantifiers ("one", "five hundred", etc.) standardly occur with the nouns in (C). So-called measures of amount like "ten-gallons-of" and "two-teaspoons-of", on the other hand, follow the same pattern as "little" and "much" in standardly combining with the nouns listed under (M).

Let's call quantifiers, such as "much" and "little", which standardly combine with the nouns in (M) "*mass-quantifiers*"; those which standardly combine with the nouns in (C) I shall call "*count-quantifiers*". We can now state two more rules of classification:

(R₂) An occurrence of a noun Φ in the context ' $\dots Q_M \dots \Phi \dots$ ' is a *mass-occurrence*.²⁷

(R₃) An occurrence of a noun Φ in the context ' $\dots Q_C \dots \Phi \dots$ ' is a *count-occurrence*.²⁸

²⁷ I am using single quotes to stand for corner-quotes.

²⁸ Of course, the quantifier and the noun have to be hooked up in some way to form a single syntactic component. (R₂) is not intended to be interpreted in such a way that the occurrence of "John" in the sentence "Much of what John said was true" is classified as a mass-occurrence, simply because "John" and the mass-quantifier "much" occur in the same sentence. The same holds for (R₃)-(R₆).

Q_M is meant to stand for "mass-quantifier"; Q_C stands for "count-quantifier".

(R_2) & (R_3) are only a first approximation. To make these rules of classification more precise, we would need to incorporate a number of other facts. First, compound quantifier-expressions, such as "too few", "much more", "each of the two gallons of", and so forth, would have to be accounted for in (R_2) & (R_3). Since there is a large number of possible combinations, actually listing them would be quite a tedious task.

Moreover, (R_2) & (R_3) would have to be refined in such a way as to correctly classify "all", "most", "more", "a lot of", etc. + singular noun-occurrences as well as certain senses of "some" as mass-quantifiers, as in

(48) He poured some water into my glass.

(49) All gold is valuable.

In addition, we would need a rule concerning bare (i.e. unquantified) singular occurrences of nouns, as in

(50) Water is good for you.

All such occurrences of nouns (unless the noun in question is a proper name) are mass-occurrences. Thus,

(R_4) A bare singular occurrence of a noun is a *mass-occurrence*.

More importantly, however, contexts such as the following might appear more worrisome for a purely syntactic approach to Project (i):

(51) The apple in my dessert is moldy.

(52) Mary had a little lamb.

Are the occurrences of "apple" and "lamb" in (51) & (52) mass-occurrences or count-occurrences? Intuitively, (51) & (52) are ambiguous between a mass and a count-reading. The ambiguity in (51) has to do with the fact that the definite article can be both a mass and a count-quantifier. The ambiguity in (52), on the other hand, has to do with the fact that "little" can function both as an adjective and as a quantifier. The two readings of (51) & (52) can be paraphrased in the following manner:

- (53) a. All (of) the apple in my dessert is moldy.
 b. There is a unique apple in my dessert, such that it is moldy.
- (54) a. Mary had some, but not much, lamb.
 b. Mary had a small lamb.

But, with their paraphrases as given in (53) & (54), the two readings of (51) & (52) can be accommodated under the rules of classification (R_2) & (R_3), when stated in a more precise manner. "All (of) the" + singular noun-occurrences can be added under the list of compound mass-quantifiers. "Much" and certain occurrences of "some" + singular noun-occurrences have already been listed as mass-quantifiers. "A", of course, is count.

But (54.b) is also interesting for other reasons. It suggests that (R_1)-(R_4) are incomplete in another sense. Certain adjectives, such as "small", seem to be just as reliable in picking out count-occurrences as certain quantifiers and the plural. Thus, the rules of classification should include the following two rules for adjectives:

- (R_5) An occurrence of noun Φ in the context ' $\dots A_M \dots \Phi \dots$ ' (or ' $\dots \Phi \dots A_M \dots$ ') is a *mass-occurrence*.
- (R_6) An occurrence of noun Φ in the context ' $\dots A_C \dots \Phi \dots$ ' (or ' $\dots \Phi \dots A_C \dots$ ') is a *count-occurrence*.

A_M stands for "mass-adjective" and it includes color-adjectives, such as "red", in one of its meanings: roughly "red all the way through". (Compare "red ink" with "red house".) Most adjectives that standardly occur with the nouns in (M) can also occur with those in (C): "dry", "hot", "liquid", "moldy", "loud", "damp", "muddy", "solid", etc. When they do, they do not need to be taken to mean "dry all the way through", etc.; but it may nevertheless be possible to discern some other shift in meaning. A_C stands for "count-adjectives", such as "small", "numerous", "spherical", "square" and the like.

Suppose now we could sharpen and extend the classificatory rules we have come up with so far to a system of rules $(R_1)-(R_n)$

SYNTACTIC RULES OF CLASSIFICATION:

- (R_1) A plural occurrence of a noun is a *count-occurrence*.
- (R_2) An occurrence of a noun Φ in the context ' $\dots Q_M \dots \Phi \dots$ ' is a *mass-occurrence*.
- (R_3) An occurrence of a noun Φ in the context ' $\dots Q_C \dots \Phi \dots$ ' is a *count-occurrence*.
- (R_4) A bare singular occurrence of a noun is a *mass-occurrence*.
- (R_5) An occurrence of a noun Φ in the context ' $\dots A_M \dots \Phi \dots$ ' (or ' $\dots \Phi \dots A_M \dots$ ') is a *mass-occurrence*.
- (R_6) An occurrence of a noun Φ in the context ' $\dots A_C \dots \Phi \dots$ ' (or ' $\dots \Phi \dots A_C \dots$ ') is a *count-occurrence*.
-
-
-
- (R_n)

such that $(R_1)-(R_n)$ are sufficient to classify *every* occurrence of a noun as either mass or count. The assumption that it is possible to come up with a set of rules of this kind does not

strike me as too preposterous, given the example set by (R₁)-(R₆). (R₁)-(R_n) would then furnish us with a set of syntactic criteria sufficient to answer the questions posed by (i).

It is difficult to say, without lots of linguistic theory in the background, whether I have, at least in outline, successfully pinned down the relevant grammatical contexts to distinguish mass-occurrences from count-occurrences of nouns. It is conceivable that we might come across counter-examples. A counter-example to my scheme of classification would consist in a noun-occurrence, which, for some reason or other, we want to be classified one way (say, count), but which, according to the syntactic criteria, gets classified the other way (as a mass-occurrence). One might consider nouns like "furniture", "cattle", "china", and "jewelry" to constitute just such counter-examples. The syntactic scheme of classification would group these nouns together with "water", "snow" and "gold". However, it has often been said that, in spite of their singular appearance, these nouns, in their standard occurrences, are really disguised plurals; more like "horses" and "people" than like "water", "snow" and "gold".

The intuition that standard occurrences of "furniture" are really disguised plural count-occurrences seems to originate from the following fact. Furniture consists of nicely individuated items: *pieces* of furniture, viz. chairs, tables, beds, and the like. Each of these can be referred to by means of a noun that standardly has count-occurrences ("chair", "table", "bed", etc.). Moreover, parts of a piece of furniture are usually not themselves furniture: a leg of a chair is not itself a chair. In contrast, parts of a grain of sand are still themselves sand (unless we keep dividing for a very long time).²⁹

The topic of disguised plurals certainly raises interesting questions. For instance, nouns like "furniture" make us wonder how we came up with our list of syntactic rules of

²⁹ For a very illuminating discussion, see Helen Cartwright (1963), pp.237-247.

classification in the first place. Were there some underlying metaphysical or semantic intuitions that guided our decisions? If so, what were they? Also, if there are such underlying intuitions, should we not classify according to those facts, rather than what syntax has to offer us?

It seems to me that there must be such underlying semantic and metaphysical facts and that, accordingly, we must have underlying semantic and metaphysical intuitions. Surely, it cannot not be via direct syntactic intuition that we connect the phenomenon of pluralization with such quantifiers as "many" and "few" as pointing to one particular class of noun-occurrences. Surely, we have some other reasons to do so. The next chapter will investigate some of the semantic and metaphysical features that may be guiding us in this context. However, in the meantime, we should not give up on the syntactic approach too quickly. The fact that there are such underlying intuitions does not make the syntactic approach bankrupt. Rules of classification, as long as they produce the right results, do not necessarily need to be cast in terms of what is most conceptually prior. Rules of classification themselves do not claim to explain *why* we classify this way. They merely classify.

Moreover, although I will not argue for this claim here, I am not convinced that nouns like "furniture" do constitute a counter-example to the syntactic scheme of classification. As far as I can see, there is nothing wrong with classifying "furniture" as a noun that standardly has mass-occurrences, rather than one that standardly has plural count-occurrences. The intuitions that would make us classify typical occurrences of "furniture" as disguised plural count-occurrences, upon consideration, do not amount to very much: they are, it seems to me, based on the mistaken prejudice that nouns in their mass-occurrences must denote something stuff-like. But more on this below.

IV. LOGICAL FORM

1. The Problem of Logical Form: Let's now turn to the Problem of Logical Form (Project (ii)), specifically the second question concerning mass-occurrences of nouns:

(ii) LOGICAL FORM:

What is the logical form of sentences containing mass-occurrences of nouns?

There are, in the literature, three general strategies concerning the Problem of Logical Form:

THE NAME-VIEW:

When a noun has a mass-occurrence, it always functions semantically as a name.

THE PREDICATE-VIEW:

When a noun has a mass-occurrence, it always functions semantically as part of a predicate.

THE MIXED VIEW:

When a noun has a mass-occurrence, it functions semantically either as a name or as part of a predicate.

In chapter II., we discussed a representative of each of these three strategies: Quine (1960), Parsons (1970) and Burge (1972). Let me briefly summarize what these proposals were.

It turned out that there are two different readings of Quine: the dual-role analysis and the single-role analysis. According to Quine's dual-role analysis, nouns in their mass-occurrences can function either as names or as parts of predicates, depending on their position in the sentence with respect to the copula. When a noun has a mass-occurrence and precedes the copula, it plays the semantic role of a name. In this role, nouns that have mass-occurrences refer to scattered objects. Thus, when "water" has a mass-occurrence, it plays the role of a name of the scattered object water, the totality of the world's water. When a noun has a mass-occurrence and follows the copula, it functions semantically as part of a predicate.

Quine's dual-role analysis does not spell out what the semantic contribution of nouns in their mass-occurrences is, when these nouns function as parts of predicates.

According to Quine's single-role analysis, nouns that have mass-occurrences always function as names. Of course, there are sentences which intuitively do not talk about the whole scattered object in question. To account for such cases, Quine introduces reference-dividing relations, such as "is-a-bit-of", "is-a-piece-of", "is-a-portion-of", and the like. These reference-dividing relations hold between particular instances of a given scattered object and the scattered object itself.

Parsons' proposal was seen to be very similar to Quine's single-role analysis. There are certain metaphysical differences between Quine and Parsons, but, semantically, the two are very close. According to Parsons, nouns that have mass-occurrences also function fundamentally as names. His account differs from Quine's, however, in that it contains only a single reference-dividing relation, "is-a-quantity-of", which relates particular instances of a given scattered object to the whole scattered object.

Both Quine's and Parsons' single-role analysis take up one of the directions suggested by Quine's dual-role analysis: the view that nouns that have mass-occurrences play the semantic role of a name. Burge develops the other direction suggested by Quine's dual-role analysis. According to Burge's proposal, nouns that have mass-occurrences always function semantically as parts of predicates. These predicates are to be understood as count-predicates in disguise. Thus, "is-water", for instance, is really short for "is-a-water" (or "are-waters").

We saw in chapter II. that there is something wrong with all three proposals. Quine's dual-role analysis, as it stands, cannot account for the validity of simple inferences, such as the Burge-inference in (11):

(11) Snow is white.

This stuff is snow.

This stuff is white.³⁰

In order for these inferences to come out valid, some semantic connection must be established between the predicative and the non-predicative role of nouns in their mass-occurrences, such that it becomes clear that it is in fact one and the same expression which is playing these two roles. Quine's dual-role analysis failed to establish such a connection.

The problem with Quine's single-role analysis has to do with the reference-dividing relations of which it makes crucial use. These reference-dividing relations implicitly contain what they are designed to explain away. In order to understand the reference-dividing relation that holds between, say, a particular quantity of water and the totality of the world's water, we need to have a grasp of the predicate "is-water" itself and what it is for "is-water" to be true of something. The same objection applies to Parsons' single-role analysis.

Burge's proposal was unattractive, because it eliminates the contrast between mass-occurrences and count-occurrences of nouns entirely. On Burge's view, we are to read "is-hair" as short for "is-a-hair" (or "are-hairs"). Thus, (55.a) turns out to be synonymous with either (55.b) or (55.c):

- (55) a. This is hair.
- b. This is a hair.
- c. These are hairs.

³⁰ Note that this inference is valid only if the first premise is read universally. This is not how we would commonly read it. However, since most writers on the subject seem to consider this inference valid, I will not take issue with it here. Whether or not the inference is valid, it serves the purpose it is meant to serve: it brings out that some semantic connection must be established between the two occurrences of "snow".

But this consequence should strike us as quite unintuitive. "Hair" has two different occurrences in (55): in (55.a) it has a mass-occurrence; in (55.b) & (55.c) it has a count-occurrence. Intuitively, we feel that there is a contrast between these two kinds of occurrences of "hair". To reduce (55.a) to (55.b) or (55.c) is to say that this contrast is only apparent and not real.

The question now is which view should *we* take? I shall ultimately opt for the predicate-view, though a different version of it from the one suggested by Burge. This move must, of course, be justified. There is no doubt that the first two views have certain strengths, even though they both gave rise to serious difficulties. In particular, there is a class of sentences which seem intuitively to count against the predicate-view and in favor of the mixed and the name-view. What I have in mind are sentences of the following kind:

- (56) a. Water is wet.
- b. Snow is white.
- c. Gold is valuable.

These are precisely the kinds of sentences from which the first two views derive their intuitive appeal. They are also the kinds of sentences which first motivated Quine to think that nouns in their mass-occurrences should be analyzed as playing the semantic role of a singular term.

Let me now turn to the class of sentences illustrated in (56) and say why these sentences in fact should *not* be taken as counting against the predicate-view, and in favor of the mixed and the name-view. In the course of doing so, I commit myself to a particular analysis of the wider class of sentences to which those in (56) belong, viz. the class of *generic* sentences. According to this analysis, generic sentences are implicitly *quantificational*, rather than of *subject/predicate* form. They *seem* to speak of the *totality* of the world's water, snow, gold and the like; but, in fact, according to the analysis I adopt, they speak of *particular*

instances of the world's water, snow, gold and the like. This analysis is, I believe, attractive in its own right. However, from a methodological point of view, we are here also dealing with an interesting example of "one thing leading to another". For our starting-point was the general question:

(ii) LOGICAL FORM:

What is the logical form of sentences containing mass-occurrences of nouns?

For various reasons, it then turned out that a particular version of the predicate-view appears to be the most attractive proposal in response to (ii). But this proposal leads to another proposal regarding a semantic issue which is not specific to the mass/count distinction, namely the issue of generic sentences. And generic sentences will be our next topic.

2. Generic Sentences: Intuitively, the sentences in (56)

- (56) a. Water is wet.
b. Snow is white.
c. Gold is valuable.

look as if they are of subject/predicate form, much like (57):

- (57) John is intelligent.

"Water", "snow" and "gold", in (56), and "John", in (57), seem to be playing much the same role: that of a singular term. In contrast, consider the following sentences:

- (58) a. My ring is made of gold.
b. There is snow in my garden.
c. Ice is melting outside.

The occurrences of "gold", "snow" and "ice" in (58) do not bear much similarity to the occurrence of "John" in (57). "Gold", "snow" and "ice" do not seem to be playing the role of a singular term in (58).³¹

On both the mixed and the name-view, (56.a)-(56.c) receive a very straightforward treatment. For instance, "snow" in (56.b), according to both Quine and Parsons, would be analyzed as referring to the scattered object or substance snow. The predicate "is-white" is applied directly to the scattered object or substance referred to by the subject term.

Because (56.a)-(56.c) are about the whole scattered object or substance in question, they do not require the use of a reference-dividing relation. But its appeal to reference-dividing relations was precisely what struck us as problematic about the name-view. The name-view is thus at its best when dealing with sentences like (56). Sentences like those in (58), on the other hand, which do not talk about the whole scattered object or substance in question, will require the use of a reference-dividing relation. This is where the name-view is at its weakest.

The mixed view has a straightforward way of dealing with both the sentences in (56) and those in (58), when taken in isolation. For example, it assigns two different semantic roles to the noun "snow" in its occurrences in (56.b) & (58.b): that of a name in (56.b) and that of a predicate in (58.b). But, as we have seen earlier, the mixed view runs into trouble when sentences from these two groups are combined in inferences, such as (11).

The predicate-view, which denies that nouns in their mass-occurrences can ever play the semantic role of a name, would have to assign a more complex logical form to the sentences in (56). Such a view will have to explain away the name-like appearance of the

³¹ I do not mean to suggest that singular terms are only to be found in subject position. I merely take the use of "John" in (57) to be prototypical.

noun occurring in subject-position somehow. However, the predicate-view will, in turn, have an easier time with sentences like (58). The nouns which have mass-occurrences in (58) seem to be straightforwardly predicative.

Nevertheless, the predicate-view does have a way of handling the sentences in (56). The sentences in (56) belong to a special class: the class of *generic* sentences.³² As we shall see shortly, there is an attractive treatment of the class of generic sentences as a whole which the predicate-view can adopt. Since the sentences in (56) belong to the larger class of generic sentences, the predicate-view thereby has a way of dealing with the sentences in (56).

What is a generic sentence? Intuitively, generic sentences say that some property is true of a thing or collection of things *in general*. For example, (56.b) says that it is generally true of the stuff, snow, that it is white. Here are some other well-known examples of generic sentences:

- (59) a. Whales are mammals.
b. The whale is a mammal.
c. A whale is a mammal.
- (60) a. Dogs are faithful pets.
b. The dog is a faithful pet.
c. A dog is a faithful pet.
- (61) a. Guppies give live birth to their young.
b. The guppy gives live birth to its young.
c. A guppy gives live birth to its young.
- (62) a. Dutchmen are good sailors.
b. A Dutchman is a good sailor.³³

³² For a discussion of generic sentences, see, e.g., Gregory Carlson (1977a), (1977b), (1979), (1982), (1989), Chierchia (1982), Farkas & Sugioka (1983), Krifka (1987), (1988), Krifka et al. (forth), Lewis (1975), Schubert & Pelletier (1987), (1989), Wilkinson (1991).

³³ This list of examples is by no means exhaustive. In particular, I am for now purposefully omitting sentences of the following kind:

Everyone seems to agree that (59)-(62), as well as (56), constitute good examples of generic sentences. Commonly, one also finds so-called *habitual* sentences included among the class of generic sentences; that is, sentences of the following kind:

- (64) a. John smokes.
- b. John walks to work.
- c. John beats his children.³⁴

What is it that marks a sentence as generic? What exactly do (56), (59)-(62) & (64) have in common? This question has not yet been given a satisfactory answer. Given that generic sentences say that some property is true of a thing or collection of things *in general*, they are weaker than universally quantified sentences, such as (65):

- (65) All men are mortal.

Generic sentences assert some sort of (law-like) generalization, general tendency, disposition, characteristic, or regularity. We can insert adverbs like "generally", "characteristically", "typically" and "normally" into many (though not all) of these sentences without distorting their meaning. Sentences which fall under this admittedly vague characterization have two commonly noted features.

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- (63) a. Dinosaurs are extinct.
 - b. Dinosaurs are rare/common/widespread.

Sentences of this kind are commonly regarded as generic. However, as we shall see below, (63.a) & (63.b) differ from the rest of the group in certain interesting respects.

³⁴ We might also regard sentences such as "Lying is wrong" and the like as generic. In this case, the study of generics could conceivably shed some light on the notion of *prima facie* duties.

First, they tolerate (but do not require) exceptions. Thus, "Snow is white" is considered true even if the snow we see around us is often brown.³⁵ (60.a)-(60.c) are considered true, even in the face of an occasional unfaithful dog. (61.a)-(61.c) are considered true, even though some guppies (namely the male ones as well as the infertile female ones) do not give birth to anything at all. (62.a)-(62.b) are considered true, even though very few Dutchmen are actually good sailors, because few of them are sailors. (64.a)-(64.c) are considered true, even though there are occasions on which we would expect John to smoke, walk to work or beat his children, but, for some reason or other, he refrains from doing so.

Secondly, there is no absolute number or specific proportion of instances of the kind of thing in question which would make all generic sentences true. Some are true only if *all* instances of the kind in question have the property in question (e.g. (59.a)-(59.c)). Some only require *most* instances to have the property (e.g. (60.a)-(60.c)). For some, even fewer instances need to have the property in question. For instance, to make (61.a)-(61.c) true, less than half of all guppies, namely the healthy female ones, need to have the property in question. To make (62.a)-(62.b) true, only very few Dutchmen need to have the property in question. The few Dutchmen who choose to become sailors, by and large, must be good sailors. More strongly, it must be the case that those Dutchmen who do not choose to become sailors by and large would be good sailors, if they chose to be sailors.

³⁵ In fact, it is hard to say what exactly it would take for "Snow is white" to come out false. Perhaps, it would be true, even if *none* of the snow around us is white. Perhaps, all that is required is for snow to be white, upon its conception, or when it first touches the ground (before the pollution and other mitigating factors can discolor it), or something along those lines.

One intuitively attractive way of dealing with generic sentences is to view these sentences as *relational*.³⁶ This view is suggested in Carlson (1989) and further developed in Krifka (1987) & (1988). According to this analysis, generic sentences have the following *tripartite* structure, consisting of a dyadic generic operator and its two arguments:

RELATIONAL ANALYSIS.³⁷

GEN [x] [F(x), G(x)]

This schema is to be read as "Generally, cases in which x is F are such that x is also G". The F(x)-part before the comma is commonly called the *background* or *restrictive clause*; the G(x)-part after the comma is called the *focus* or *nuclear scope*.

Very briefly, the locus of genericity, on this view, is no longer the subject term. The genericity is now located in the generic operator, which has scope over the whole sentence. The generic operator is typically said to be a generalized quantifier, which unselectively binds all the free variables in the sentence.³⁸ For one thing, "GEN" indicates a relation of cardinality between the Fs and the Gs. But it also does more than that: it is a special feature

³⁶ This account of generic sentences is not only intuitively attractive but should actually be preferred over the subject/predicate analysis. Unfortunately, I cannot defend this thesis here.

It has been pointed out to me that the label "relational" is slightly misleading and that "quantificational" would be preferable. However, since "relational" has now established itself in the literature, I will not confuse matters by using "quantificational" instead. Also, the two labels come to the same anyway, since quantifiers are nowadays often conceived of as relations between sets.

³⁷ I should warn the reader not to expect too much from the "*Analysis*" in "Relational Analysis". No real analysis has been provided until we are clearer about the nature of the quantifier "GEN". My discussion is not very illuminating in this respect. However, all I need for my present purposes (and I do not take myself to have established anything more than this) is that generic sentences can be analyzed as implicitly quantificational, as opposed to being of subject/predicate form.

³⁸ For more details on generalized quantifiers, see, e.g., Barwise & Cooper (1981); for more details on unselective binding, see, e.g., Lewis (1975), Heim (1982).

of generic sentences that the Fs are *typically* or *characteristically* Gs. Thus, generic sentences have something lawlike to them, although the lawlikeness may differ from case to case (e.g. the lawlikeness with which whales are mammals is quite different from that with which John beats his children). To account for the lawlike character of generic sentences, "GEN" is taken to be a modal operator involving various kinds of necessity (e.g. linguistic necessity, i.e. analyticity, mathematical necessity, metaphysical necessity, or various weaker kinds of necessity).

According to the relational account, (59)-(62) receive the following analysis:

- (59)' GEN (x) [Is-a-whale(x), Is-a-mammal(x)]
- (60)' GEN (x) [Is-a-dog(x), Is-a-faithful-pet(x)]
- (61)' GEN (x) [Is-a-guppy(x), Gives-live-birth-to-its-young(x)]
- (62)' GEN (x) [Is-a-Dutchman(x), Is-a-good-sailor(x)]³⁹

(59') is true if and only if in general every whale is a mammal. Similarly in the case of (60')-(62').

The relational analysis of genericity is very promising for the predicate-view. If generic sentences can be analyzed as quantificational, as the relational analysis says they can, then they no longer count in favor of the mixed or name-view. According to the relational analysis, the special character of generic sentences is no longer connected with a special sort

³⁹ (59')-(62') are simplified in various respects. For one thing, (59')-(62') gloss over the fact that (59)-(62) contain different kinds of noun-occurrences: definite singular count-occurrences ("the whale"), indefinite singular count-occurrences ("a whale"), and plural occurrences ("whales").

The sentences in (64) are somewhat different from the ones in (59)-(62), in that we are here dealing with quantification over situations (or some such entity). For example, (64.a) says roughly that John generally smokes in every situation in which one might expect him to smoke. Similarly in the case of (64.b) & (64.c).

Since I am here mainly concerned with generic sentences containing mass-occurrences of nouns, I will not discuss the issues raised specifically by (59)-(62) & (64) any further.

of entity referred to by the subject term. Instead, their special character derives from the properties of the generic operator.

According to the relational analysis, our original sentences (56.a)-(56.c) would receive the following analysis:

- (56) a.' GEN [x] (Is-Water(x), Is-Wet(x))
- b.' GEN [x] (Is-Snow(x), Is-White(x))
- c.' GEN [x] (Is-Gold(x), Is-Valuable(x))

(56.a') is true iff generally every x that is water is also wet. Similarly for (56.b') & (56.c').

When we say that snow is white and that water is wet, we are only thinking of reasonably-sized quantities of snow and water. H₂O-molecules are neither wet nor white.

(56.c') is somewhat different. We might distinguish two senses of "is-valuable": proportional value and absolute value (comparable to proportional weight and absolute weight). Depending on which sense is at play in (56.c'), tiny specks of gold either would or would not count as valuable. If we are thinking of proportional value, tiny specks of gold are still more valuable than tiny specks of most other things. If, on the other hand, we are considering absolute value, tiny specks of gold would not count as particularly valuable.

The most plausible way to incorporate this prima facie difficulty is to build some sort of qualification into the predicate. The predicate in question is to be understood in a restricted fashion, as only applying to reasonably-sized portions. What counts as a reasonably-sized portion must be specified independently (via non-semantic means).

But this difficulty is not unique to the relational analysis of generic sentences. The proponent of the subject/predicate analysis must also face the problem of *how* the predicate applies to the denotation of the subject term. Consider Quine's proposal. According to Quine, "snow" in (56.b) refers to the scattered object snow and "is-white" is predicated directly of the

scattered object. Scattered objects are mereological sums. What is it for the mereological sum, snow, to be white? For a mereological sum to be white cannot simply be for every single part of it to be white. Single H₂O-molecules, on a very intuitive reading of parthood, are part of the scattered object snow, but, taken by themselves, they do not have color. Thus, the subject/predicate analysis is no better off than the relational analysis.

We have now seen that generic sentences of the kind in (56) need not be taken as counting against the predicate-view and in favor of the mixed and the name-view. There is an intuitively attractive way of treating the class of generic sentences as a whole, the relational analysis of genericity, which allows the predicate-view to handle our initial examples in (56). The relational analysis is intuitively attractive for two reasons. First, it allows for a clean analysis of our initial examples in (56), the kinds of sentences which first motivated Quine. Secondly, the relational analysis applies to the class of generic sentences as a whole, regardless of whether these sentences contain mass-occurrences of nouns. It works equally well for generic sentences containing singular or plural count-occurrences of nouns as well as proper names, as in (59)-(62) & (64).

Let me now turn to some apparent difficulties for the relational analysis of genericity. What I have in mind are sentences of the following kind:

- (66) a. Gold was first discovered by the Sumerians.
- b. Gold is no longer mined in Arizona.⁴⁰

⁴⁰ These sentences belong to the group of sentences Krifka (1987) & (1988) calls D-Generics. This group also includes the following sentences, already mentioned earlier:

- (63) a. Dinosaurs are extinct.
- b. Dinosaurs are rare/common/widespread.

Since I am here only concerned with sentences containing mass-occurrences of nouns, I will not discuss (63.a) & (63.b) separately. However, most of what I say about (66.a) & (66.b) will also apply to (63.a) & (63.b), *mutatis mutandis*.

(66.a)-(66.b) differ, for example, from "Gold is valuable" (example (56.c)) in the following respect. Intuitively, "Gold is valuable" asserts of particular instances of the kind, gold, that *they* typically have the property of being valuable. As the paraphrase in (56.c') indicates, the predicate "is-valuable" nicely distributes over the instances of the kind, gold. It makes sense to say of particular instances of gold that *they are* valuable. (The same holds for "Snow is white" and "Water is wet".) In contrast, the predicates in (66.a)-(66.b) do not distribute over the instances of the kind of thing in question:

- (66) a.' GEN [x] (Is-gold(x), Was-first-discovered-by-the-Sumerians(x))
- b.' GEN [x] (Is-gold(x), Is-no-longer-mined-in-Arizona(x))

(66.a')-(66.b') do not correctly reflect the meaning of (66.a)-(66.b). (66.a)-(66.b) seem to speak about the stuff, gold, directly. It is not individual instances of gold which the Sumerians first discovered: (66.a) says of the stuff, gold, that *it* was discovered by the Sumerians. Similarly, (66.b) says of the stuff, gold, that *it* is no longer mined in Arizona (though the contrast may be somewhat less stark in this case). (56.c), on the other hand, attributes characteristic properties to individual instances of the stuff, gold.

On the face of it, (66.a)-(66.b) seem to point more in the direction of a subject/predicate analysis of genericity, rather than a quantificational account. However, (66.a) & (66.b) are quite different from all the other sentences we have encountered so far. Indeed, (66.a) & (66.b) are *so* different from all the rest that we should ask ourselves why and whether they ought to count as generic at all. Traditionally, sentences of this kind are regarded as generic, precisely because the predicates appearing in them do not sensibly apply to individual instances of the thing in question. These sentences appear to speak about a species or stuff directly, rather than individual instances of it. But the term "generic" is, of course, a term of

art. We need some reason for classifying (66.a) & (66.b) as generic, alongside with (56), (59)-(62) & (64). It is hard to believe that we have some direct, pretheoretic intuition as to which sentences are generic and which ones are not. On the other hand, we do have the intuition that the examples given earlier, in (56), (59)-(62) (and perhaps also, though less obviously so, those in (64)), have something in common. They all assert that, by and large, individual instances of a kind of thing have a certain characteristic property. Furthermore, we also have the intuition that (66.a) & (66.b) have something in common. Both sentences seem to attribute something relatively non-characteristic to a kind of thing directly. What is much less obvious, however, is that (66.a) & (66.b) are, in any interesting way, like our earlier examples.

(66.a) & (66.b) no doubt *seem* to speak about the stuff, gold, directly. However, it is one thing to agree that (66.a)-(66.b) seem to speak about the stuff, gold, directly and quite another to propose that these sentences *must* be given a subject/predicate analysis, with the subject term functioning as a referring expression. We may not be able to attribute the property of being discovered by the Sumerians or the property of being no longer mined in Arizona directly to individual instances of the stuff, gold. But *something* must be happening to individual instances of the stuff, gold, in order for (66.a)-(66.b) to be true. In other words, it is possible to paraphrase (66.a)-(66.b) in terms of instances of the stuff, gold, even if such paraphrases will involve "unpacking" the predicates "was-first-discovered-by-the-Sumerians" and "is-no-longer-mined-in-Arizona". My paraphrases will be quite sketchy.

(66.a) says, roughly, that the first time anyone ever found any gold, it was the Sumerians. One way to represent this is as follows:

(66) a.' $\exists t \exists p \exists x$ [[Find(Sumerians,x,t,p) & Is-gold(x) & t<Now] & $\neg \exists t' \exists p \exists y \exists z$
[Find(y,z,t',p) & y≠Sumerians & Is-gold(z) & t'<t]]

(66.a'') reads "There is a time t and a place p , such that the Sumerians found some gold at t in p and t is before now, and there is no prior time t' at which anyone else found any gold anywhere". I am assuming that to discover the stuff, gold, is, at least roughly, to find individual instances of gold.⁴¹

(66.b) says that gold used to be mined in Arizona, but no longer is:

(66) b.'' $\exists t \exists x \exists y$ [Dig-up(x,y,t , Arizona) & Is-gold(y) & $t < \text{Now}$] & $\neg \exists x \exists y$ [Dig-up($x,y,\text{Now},\text{Arizona}$) & Is-gold(y)]

(66.b'') reads "There is a time t , before now, such that someone dug up some gold in Arizona at t , and it is not the case that anyone digs up any gold in Arizona now". I am assuming that to mine the stuff, gold, is, at least roughly, to dig up individual instances of gold.

If these, admittedly rough, suggestions point in the right direction, it becomes questionable whether (66.a)-(66.b) should even count as generic sentences. I see no obvious place for a generic operator in (66.a'') & (66.b''). According to these paraphrases, (66.a)-(66.b) speak of people doing certain things involving particular instances of the stuff, gold. But the class of generic sentences was rather ill-defined to begin with and we should not be surprised to find that sentences which we thought might be generic, upon consideration, turn out not to be.

It might be thought to be a difficulty with my paraphrases that the logical form of (66.a)-(66.b) is now quite far removed from their surface grammar. Ideally, we would want some non-ad-hoc procedure to take us from the surface grammar to the logical form of any given sentence. Given the rather messy logical form assigned to (66.a)-(66.b), it is not

⁴¹ If there is a use of "discover", according to which we can discover individual instances of gold (and perhaps discover the kind gold by discovering individual instances of it), we might make the logical form of (66.a) less messy by leaving "discover" untouched, i.e. not replace it by "find". The same holds for "mine".

obvious how this could be accomplished. However, this difficulty with my analysis results from what might be thought to be one of its virtues. My analysis "unpacks" the predicates "was-first-discovered-by-the-Sumerians" and "is-no-longer-mined-in-Arizona": to discover the stuff, gold, is, roughly, to find individual instances of gold; and to mine the stuff, gold, is, roughly, to dig up individual instances of gold. It is this "unpacking"-operation which creates the distance between logical form and surface grammar. However, by "unpacking" the predicates, we also *explicate their meaning*. Presumably, anyone concerned with the analysis of natural-language sentences must face the task of explaining the meaning of a predicate *somewhere*. What does it mean for gold to be discovered or no longer mined? According to my approach, at least some of the explaining takes place at the level of logical form, whereas other approaches might assign this task exclusively to the lexicon.

The distance between surface grammar and logical form becomes particularly drastic when we consider mixed sentences of the following sort:

(67) Gold, which is valuable, was first discovered by the Sumerians.

(67) is "mixed", in the sense that its non-restrictive relative clause attributes a characteristic property to individual instances of the stuff, gold. Its main clause, on the other hand, appears to attribute the property of being first discovered by the Sumerians to the stuff, gold, directly.

As we have seen earlier in (56.c'), the relative clause of (67) should be analyzed as involving generic quantification over instances of the stuff, gold. The main clause of (67) was analyzed in (66.a'') as an existential quantification over people, individual instances of gold, times and places, with no obvious place for a generic operator. Thus, the only way to account for (67), on this current view, is to simply conjoin (56.c') and (66.a''). This is not a particularly pretty solution to the problem of mixed sentences. For, ideally, the logical form

assigned to (67) should reflect the fact that (67) looks as though the main clause and the relative clause have *one and the same* subject term.

In light of sentences like (67) and the difficulties created by them, one might feel more sympathetic towards a view that allows for different levels of analysis (and hence different levels of logical form). On such a view, we could capture the surface-grammar of (67) by analyzing it, on one level, as of subject/predicate form, with "gold" as the subject for the entire sentence:

(67)' [Is-valuable(gold) & Was-first-discovered-by-the-Sumerians(gold)]

Now, superficially, this paraphrase employs "gold" as a name for a kind. This, of course, if we take it ontologically seriously, would run contrary to everything I have said in this section. However, I have nothing against a paraphrase like (67'), as long as we do not take it ontologically seriously. (67') is acceptable if we construe it only as a first level of analysis. When we then ask what it really means for the kind, gold, to be valuable, it will turn out that what this comes to is for individual instances of it to be generally valuable, just like on my earlier account. Similarly, when we ask what it really means for the kind, gold, to have first been discovered by the Sumerians, it will turn out that what this comes to is for individual instances of it to have first been found by the Sumerians, just like on my earlier account. (This, of course, also means that there must be two predicates "is-valuable" and "discover", one applying to kinds and one applying to individual instances of the kind; but the former could be defined in terms of the latter.) This would be one possible way to preserve the surface-grammar of (67) in an ontologically harmless way. (However, I should say that my own preference would be to minimize levels of analysis, even if this will result in an aesthetically less pleasing account.)

To conclude, we have seen that there is a class of sentences, such as those in (56), which intuitively seem to count against the predicate-view and in favor of the mixed and the name-view. These sentences belong to a special class, the class of generic sentences. Intuitively, it is quite attractive to view these sentences, as the mixed and the name-view would, as having a simple subject/predicate structure, with the subject term functioning as a referring expression. However, there are alternative views which are no less plausible. One alternative, the relational analysis, takes generic sentences to be quantificational. This view would be ideal for a proponent of the predicate-view. By adopting the relational analysis of genericity, the predicate-view has a straightforward way of dealing with sentences like (56.a)-(56.c). These sentences should thus no longer be taken as counting against the predicate-view and in favor of the mixed or the name-view. We encountered other examples containing name-like mass-occurrences of nouns, such as (66) & (67), which are somewhat more troublesome for the proponent of the predicate-view. The predicate-view will, in these cases, lead to a more complex logical form. But we can safely regard these cases as special: they take advantage of a very restricted set of predicates, namely those predicates which intuitively seem to apply to a stuff or a kind of thing directly.

3. An Anti-Reductionist Predicate View: Let's now consider non-generic sentences.

(68.a) is an example of such a sentence:

(68) a. This is hair.

The noun "hair", in (68.a), has a mass-occurrence. (68.a) is not a generic sentence: it does not talk about hair in general, but a particular instance of it.

Since the name-view had to be discarded, "hair", in its occurrence in (68.a), must now be analyzed as functioning semantically as part of a predicate. Now consider sentence (68.b) again:

(68) b. This is a hair.

"Hair", in its occurrence in (68.b), is also functioning semantically as part of a predicate. (68.b) is true just in case the predicate "is-a-hair" is true of the referent of the demonstrative pronoun "this". But the semantic contribution of "hair" to the whole of (68.a) must be different from its contribution to the semantic value of (68.b). Neither one can be reduced to the other, otherwise the intuitive contrast between (68.a) & (68.b) will get lost. What, then, is the difference between (68.a) & (68.b), given that "hair" is functioning as part of a predicate in both sentences?

Let's look at these two sentences more closely. Sentence (68.b) has four syntactic components: the demonstrative pronoun "this", the copula "is", the indefinite article "a" and the noun "hair". Semantically, (68.b) has two components: the subject "this" and the predicate "is-a-hair".

(68.a) differs from (68.b) only very slightly. It has three syntactic components: the demonstrative pronoun "this", the copula "is" and the noun "hair". Only the indefinite article is missing. Semantically, (68.a) also has two components, just like (68.b): the subject "this" and the predicate "is-hair".

More generally, replace "hair" in (68.b) by any noun which can sensibly occur next to the indefinite article, e.g. "man", "desk", "computer", "cigarette", etc., the result is still the same. (68.b) will still have the following two semantic components: the subject "this" and the predicate "is-a-man/desk/computer/cigarette/...". The result of substituting any noun N, which

can sensibly occur next to the indefinite article, into the schema 'is-a-_____', will be a predicate of the form 'is-an-N'.

Similarly, in the case of (68.a). Replacing "hair" in (68.a) by any noun which can sensibly occur in this position will not change the overall semantic structure of the sentence. The result of substituting any noun N, which makes sense in this position, into the schema 'is-.....', will be a predicate of the form 'is-N'. It works for "water", "gold", "mud", "snow", and the like. Replacing "hair" in (68.a) by any such noun will still leave us with the following two semantic components: the subject "this" and the predicate "is-water/gold/mud/snow/...".

So, for appropriate nouns N, substituting N for the blank in both 'is-a-_____' as well as 'is-.....' results in a predicate. But, if predicates of the form 'is-an-N' are to be different from predicates of the form 'is-N', there must then be *two different groups of predicates*. The kinds of nouns which can sensibly be substituted into the schema 'is-.....' are just those which standardly have mass-occurrences. The kinds of nouns which can be substituted into the schema 'is-a-_____', on the other hand, are just those which standardly have count-occurrences. Let's therefore call predicates of the form 'is-N' *mass-predicates* and predicates of the form 'is-an-N' *singular count-predicates*. The view I am proposing can thus be stated in the following way:

ANTI-REDUCTIONIST PREDICATE-VIEW:

- * When a noun N has a mass-occurrence, it functions semantically as part of a *mass-predicate*, of the form 'is-N'.
- * When a noun N has a singular count-occurrence, it functions semantically as part of a *singular count-predicate*, of the form 'is-an-N'.
- * Predicates of the form 'is-N' are *not reducible* to predicates of the form 'is-an-N'.

The central assumption underlying this view is that, as competent speakers of English, we have an equal grasp of both kinds of predicates. There is nothing mysterious about mass-predicates, just as there is nothing mysterious about singular count-predicates. (The mystery lies in their interconnections.) For this reason, there is simply no need for a reduction of mass-predicates to singular count-predicates, as was suggested by Burge.

In the next section, we shall look at these two kinds of predicates more closely: what the differences between them are, how they are related to one another and, finally, what they have in common. For now, the important point to remember is that it is necessary to distinguish two different groups of predicates, mass-predicates and singular count-predicates. For we have seen that nouns in their mass-occurrences must be analyzed as functioning semantically as part of a predicate. But nouns in their singular count-occurrences also function as part of a predicate. Thus, if the intuitive contrast between mass-occurrences and singular count-occurrences of nouns is to be preserved, there must then be two different groups of predicates. Neither group can be reduced to the other.

4. Homogeneity: Let's now turn to the contrast between mass-predicates, i.e. predicates of the form 'is-N' (for appropriate nouns N), and singular count-predicates, i.e. predicates of the form 'is-an-N' (for appropriate nouns N). When is a singular count-predicate true of something? The singular count-predicate "is-a-hair", for instance, is true of something *x* just in case *x* is a hair. Or, equivalently, "is-a-hair" is true of *x* just in case *x* is *one* hair. Something is *a* hair just in case it is *one* hair. In contrast, the mass-predicate "is-hair" is true of something *x* just in case *x* is hair. For "is-hair" to be true of *x*, *x* does not need to be *a* hair (though it could be). Thus, the contrast between singular count-predicates and mass-predicates can be stated as follows:

(SCP) **SINGULAR COUNT-PREDICATE:**

"Is-a-hair" is true of x iff x is a (one) hair.

(MP) **MASS-PREDICATE:**

"Is-hair" is true of x iff x is hair.

The same holds for any appropriate noun N in general.

It is often said that mass-predicates and singular count-predicates are importantly different from one another with respect to the following properties:

CUMULATIVITY:

A predicate Φ is *cumulative* iff Φ is true of any sum of things of which it is true.

DISTRIBUTIVITY:

A predicate Φ is *distributive* iff Φ is true of any part of something of which it is true.⁴²

HOMOGENEITY:

A predicate Φ is *homogeneous* iff it is both cumulative and distributive.

Now, singular count-predicates and mass-predicates are said to differ from one another in that the former are neither distributive nor cumulative, whereas the latter are homogeneous, i.e. are both distributive and cumulative. For example, a singular count-predicate like "is-a-hair" is true of all and only *whole individual* hairs. Singular count-predicates are *not* true of all parts and sums of something of which they are true. Mass-predicates, on the other hand, *are* thought to be true of all parts and sums of parts of things of which they are true.⁴³

The singular count-predicate "is-a-hair", for example, is not distributive. It is true of a particular hair, but not true of either one of the hair's two halves. One half of a hair is not a

⁴² It is open to discussion how to relation "is-a-part-of" is to be understood. I shall come back to this issue below.

⁴³ Actually, it is very easy to construct interpretations of the parthood-relation according to which mass-predicates are *not* distributive (and very hard to construct ones according to which they *are* distributive). I return to this topic later, in sections IV.8-10.

hair, only half a hair. Furthermore, "is-a-hair" is also not cumulative. "Is-a-hair" is true of each of two hairs individually, but not of their sum. The sum of two hairs is not *a* hair. Thus, the singular count-predicate "is-a-hair" is true of all and only whole individual hairs; not their parts and not their sums.

Now consider the mass-predicate "is-hair". "Is-hair" is true of something *x* if and only if *x* is hair. For "is-hair" to be true of *x*, *x* does not need to be *a* hair (though it could be). Unlike the singular count-predicate "is-a-hair", the mass-predicate "is-hair" is thought to be distributive. It is true of a particular hair; but it is also true of each of the hair's two halves. Half of one hair is still hair. Furthermore, unlike "is-a-hair", "is-hair" is also cumulative. It is true of each of two hairs individually; but it is also true of their sum. Two hairs are still hair. Thus, "is-hair" appears to be homogeneous: it appears to be true of all and only hair, as well as all parts and sums of hair.

But this first difference between mass-predicates and singular count-predicates also yields a certain relation between them. Everything that is *a* hair is also hair. However, not everything that is hair is also *a* hair: parts and sums of something that is hair are themselves hair, though not *a* hair. The same holds for all nouns which standardly have both mass-occurrences and singular count-occurrences, e.g. "chalk", "carrot", "coffee", "beer", "metal", "chicken", and the like. As a consequence, we get the following relation between mass-predicates and singular count-predicates:

ONE-WAY ENTAILMENT, COUNT TO MASS:

For any *x*, if the singular count-predicate 'is-an-N' is true of *x*, then the mass-predicate 'is-N' is also true of *x*, but not vice versa.⁴⁴

⁴⁴ There are a host of apparent exceptions to this generalization, e.g. "iron", "paper", etc. While it used to be the case that everything that is an iron is also iron, this is no longer true. However, in these cases, we are clearly dealing with two different nouns, which, for historical reasons, look the same.

It would be nice to have an entailment-relation in the other direction as well, going from mass-predicates to singular count-predicates. After all, the systematic relation between mass-predicates and singular count-predicates was meant to be an argument against a lexical-ambiguity approach and in favor of the kind of approach which says that it is *one and the same* noun "hair" occurring in both (68.a) & (68.b).⁴⁵ The lexical-ambiguity theorist might at this point object by pointing out that a mere one-way entailment between mass-predicates and singular count-predicates is too weak to maintain that we are in fact dealing with one and the same expression.

What could an entailment going in the other direction look like? We have already seen that not everything of which the mass-predicate "is-hair" is true is also such that the singular count-predicate "is-a-hair" is true of it. One might think that, in order for there to be something of which the mass-predicate "is-hair" is true (and of which the singular count-predicate "is-a-hair" is not true), there must at some point have been something of which the singular count-predicate "is-a-hair" was true. For parts of hair and sums of hair do not come into existence out of the blue. At some point, there must have been whole individual hairs, in order for there to be parts and sums of hair. Consider also the relation between "is-chicken" and "is-a-chicken". In order for there to be something of which the mass-predicate "is-chicken" is true (and of which the singular count-predicate "is-a-chicken" is not true), e.g. chicken breast, there must at some point have been something of which the singular count-predicate "is-a-chicken" was true. Again, chicken breast does not come into existence

Moreover, it was pointed out to me that the one-way entailment is a little awkward in the case of living things, such as chickens. We would not normally apply the mass-predicate "is-chicken" to chickens that are still alive, because we do not tend to think of living chickens as the meat we are going to eat.

⁴⁵ See section I., footnote 2.

spontaneously. There have to be whole individual chickens around which we can then proceed to slaughter and turn into chicken breast and other types of chicken.

Thus, there does seem to be some relation going in the other direction between mass-predicates and singular count-predicates. At least, we saw this to be the case with respect to some predicates. However, there seems to be something quite "unsemantic" about the relation between whole individual chickens and chicken breast. An entailment-relation going the other way would have to rely crucially on the natural processes by which chicken breast comes into existence from once-alive individual whole chickens. But this is clearly a contingent fact. This will become apparent if we switch to a different example, e.g. "beer". One can easily imagine a possible world in which beer is around but not drunk or employed in any other way that would require conventionally established ways of packaging beer. Such a world would be a counter-example to the inference going from mass to count. This is a world in which we cannot infer from there being something of which the mass-predicate "is-beer" is true that there must have at some point existed something of which the singular count-predicate "is-a-beer" was true. It thus looks as if there is no straightforward way of formulating an entailment-relation going from mass-predicates to singular count-predicates and we must, at least for now, be content with the one-way entailment going from singular count-predicates to mass-predicates stated above.

5. How-Many Questions: Let's now turn to the second important difference between mass-predicates and singular count-predicates. There is a reason for calling "is-a-hair" a singular *count*-predicate, rather than a singular something-else predicate. The reason is that, just as one would expect, there is some connection between singular count-predicates and *counting*. If someone asks

(69) How many hairs are there in your soup?

then the natural thing to do would be to count the individual hairs in one's soup. "Hair", in (69), has a (plural) count-occurrence and functions semantically as part of the singular count-predicate "is-a-hair":

(69)' How many x [Is-a-hair(x) & Is-in-your-soup(x)]?

Each of the things we count in response to (69) is *a* hair, i.e. *one* hair.

If, on the other hand, someone asks

(70) How much hair is there in your soup?

we might answer "a lot" or "more than last time we ate here" or "very little" or even "it looks like at least five grams of hair". "Hair", in (70), has a mass-occurrence and functions semantically as part of the mass-predicate "is-hair":

(70)' How much x [Is-hair(x) & Is-in-your-soup(x)]?

(70) *could* be posed in exactly the same circumstance as (69); that is, (69) & (70) *need* not reflect any difference in what is in our soup (although they could). But they are still two different questions and they demand different answers. (70) does not ask us to count individual hairs; rather, it asks for the *amount* of hair in one's soup. Two individual hairs cut into little shreds is the same *amount* of hair as two individual hairs *not* cut into shreds. When faced with a question like (70), we do not care what state the hair in our soup is in, we only care how much of it there is.

There definitely appears to be some connection between singular count-predicates and counting. I would like to argue that the nature of this connection is captured by the following thesis (CCQ):

CONDITION ON CARDINALITY QUESTIONS:

A question of the form 'How many Fs are?' is a cardinality question only if the Fs are isolated by a singular count-predicate of the form 'is-an-F'.

This thesis contains some technical vocabulary (viz. the terms "cardinality question" and "isolate"). In the rest of this section, I will explain what I mean by these notions and why the CCQ is supposed to capture the intuitive connection between "is-a-hair" and counting hairs.

As (69) illustrates, one way of initiating, or at least issuing a request for, an act of counting is by posing a question beginning with the words "how-many". Following Richard Cartwright's discussion of the matter in his "Notes on Aquinas' Metaphysics"⁴⁶, I take the category of how-many questions to be delineated syntactically: a how-many question is simply a question beginning with the words "how many". As it turns out, there are many different kinds of how-many questions and not all of them can be taken to issue a request to count something or other. Cartwright distinguishes, among other things, the following two kinds:

- (i) Cardinality Questions
- (ii) How-Much Questions

Cardinality questions overlap with how-many questions: that is, some but not all cardinality questions are how-many questions (i.e. begin with the words "how many"); and some but not all how-many questions are cardinality-questions. An example of a cardinality question that is not a how-many question is one beginning with the words "what's the number of". How-

⁴⁶ Richard Cartwright, "Notes on Aquinas' Metaphysics" (unpublished manuscript), p.72.

much questions also overlap with how-many questions. Some how-many questions, as it turns out, are really how-much questions, when paraphrased into their "true" form. But there are also how-many questions which are neither cardinality questions nor how-much questions. (And we are going to ignore these latter ones in what follows and focus on those, among how-many questions, that are either cardinality-questions or how-much questions.) Let's briefly consider cardinality questions and how-much questions, in turn.

Cardinality questions are roughly what Frege must have had in mind when he says, in §44 of the Grundlagen, "[w]hat answers the question How many? is number, ..."47. (69) was an example of a cardinality question. So is Frege's example

(71) How many moons of Jupiter are there?

and even

(72) How many moons of Venus are there?

despite the fact that the answer to (72) is "zero".

What is being asked in these questions? (69), (71) & (72) ask how many things of a certain kind there are. In (69), the relevant kind is hairs; in (71), it is moons of Jupiter; in (72), it is moons of Venus. We might, without harm, paraphrase (71) as follows:

(71)' How many x [Is-a-moon(x) & Belongs-To(x ,Jupiter)]?

Or, in Cartwright's notation:

(71)'' $\exists x$ [Is-a-moon(x) & Belongs-To(x ,Jupiter)]

⁴⁷ Gottlob Frege, The Foundations of Arithmetic, transl. by J.L. Austin, Northwestern University Press, 1980, p.57.

where we are to understand the ' $\exists_n x [...(x)...]$ ' construction as an existentially quantified sentence; its existential quantifier is numerically definite or indefinite and the relevant numerical value is to be supplied in the answer to the question. The how-many question in (71) issues the request to substitute the correct numerical value for the question-mark in (71''). Since the correct answer to (71) is "four", we are to substitute "4" for the question-mark in (71''), i.e.

(73) $\exists_4 x$ [Is-a-moon(x) & Belongs-To(x,Jupiter)]

(73) reads "There are (exactly) four moons of Jupiter".

Presumably, cardinality questions are so-called, because they ask for a cardinal number, as their answer. In Fregean terms, (69), (71) & (72) ask what the number belonging to the concept in question is, i.e. how many objects fall under the concept in question. In our terms, cardinality questions ask how many things there are, such that the singular count-predicate in question is true of them.

In (69), (71) & (72), the answer can be determined by counting. In (69), we would count the hairs in our soup. In (71), we would count the moons of Jupiter. In (72), we would try to count the moons of Venus, but since Venus has no moons we would end up not counting anything. Of course, cardinal numbers can be extremely large. For this reason, not all how-many questions of the first kind can be answered by actually counting the things in question. (74) also falls under the first kind, even though its correct answer is "uncountably many":

(74) How many real numbers are there?

This is one place where singular count-predicates and the act of counting part ways. (69), (71) & (72) *can* reasonably be used to issue requests to count something, but not (74). However, there are other ways (besides counting) of determining how many things of a certain kind there are. The size of the set of real numbers can only be determined by some such method, if at all. Still, it makes sense to group (74) with (69), (71) & (72), because they all ask for a cardinal number. What is most distinctive about the cardinality questions is that they demand an existential statement as its answer. The answer to a cardinality question asserts the existence of so-and-so many individual things of a certain kind.

But now consider the following example:

(75) How many apples did you eat today?

The answer to (75) could very well consist in a rational number, such as

(76) I ate three and a half apples today.

It is true that (75) contrasts in this respect with some of our previous examples. (76) presents no strain to our imagination. In contrast, (71) could not have a rational answer. There are no (detached) half, third, or quarter moons, because "moon" is (at least in part) functionally defined. A moon of Jupiter is a natural satellite revolving around Jupiter. If one of the moons of Jupiter were to be hit by a meteor and reduced to half its size, it still counts as a moon of Jupiter, rather than half a moon of Jupiter, as long as it still performs its function as a natural satellite revolving around Jupiter. (Notice that this is so, even if the half that was blown off now begins to revolve around some other planet. Now we have two moons out of what used to be one moon, without threat of paradox.) It is equally hard, though for different reasons, to think of half or third numbers. Of course, 1 goes into 2 twice, but this fact merely indicates

the ratio between the two numbers. It does not make 1 one half of the number 2 in anything like the way in which half an apple is half of one whole apple.

But (75) is still importantly similar to our previous examples. Its answer, (76), asserts the existence of three and a half apples that I ate today. We might try the following paraphrase:

(76)' $\exists_3x \exists_1y$ [Is-an-apple(x) & Is-a-detached-apple-half(y) & Eat(I,x,today) & Eat(I,y,today)]

(76)' is rather crude, but it should do the job for our present purposes. But, given the paraphrase in (76)', it now looks as though (76) is cardinal after all, because it asserts the existence of three things of one kind and one thing of another kind. The three things of one kind and the one thing of another kind do not add up to four things, unless we introduce some covering kind which includes all four of them under it. Such a kind could either be extremely general --and hence uninteresting--, such as "thing", or extremely unnatural --and hence useless--, such as "whole-apple-or-detached-apple-half". Neither option does justice to our usual practices of counting. We do not normally use the extremely general covering kind "thing" to count, because absolutely everything that our quantifiers range over would fall under it. And no one in their right mind would answer "four" to (75), using the gerrymandered "whole-apple-or-detached-apple-half" kind, unless a whole series of other changes took place first.⁴⁸

Of course, in this case, the two kinds "apple" and "detached-apple-half" are systematically related. Because apples are natural and grow on trees in certain ways, detached

⁴⁸ Note that it is a consequence of this view that eating seven apple-halves, all from different apples, does not add up to eating three and a half apples. I am not sure whether to count this consequence as a weakness or a merit. I am more inclined to see it as a merit, but my intuitions are probably biased.

apple-halves come to be out of whole apples. That is, in order for me to have eaten three and a half apples, there must have been four apples in the vicinity. But we can easily shift to an example involving artifacts:

(77) How many cars did the factory produce today?

Suppose the answer to (77) is "245 ½", i.e. 245 whole cars and one that was only finished half-way. Here, it is not true that there must have been 246 cars, in order for there to be 245 whole cars and half a car. Thus, it seems that we can group how-many questions like (75) & (77) with the rest of the cardinality questions, even though (75) & (77) admit of rational answers, whereas our earlier examples of cardinality questions, involving hairs, moons, and numbers did not.

Let's now turn to Cartwright's second kind, how-much questions. These are questions of the following kind:

(78) How many spoons of sugar do you want in your coffee?

(79) How many cups of sugar are in that bowl?

(78) & (79) can be paraphrased roughly as

(78)' How *much* sugar, as measured in spoonfuls, do you want in your coffee?

(79)' How *much* sugar, as measured in cupfuls, is in that bowl?

Of course, (75) could also be paraphrased into a question beginning with the words "how much":⁴⁹

⁴⁹ The same is true in the case of (69)

(69)' How *much* hair, as measured in individual hairs, is there in your soup?

but not in the case of (71), (74) & (77):

(75)' How *much* apple, as measured in individual apples, did you eat today?⁵⁰

But the paraphrase in (75') clearly sounds more awkward than the sentence it is supposed to paraphrase, whereas the paraphrases in (78') & (79') do not.

The difference, as Cartwright points out, is that a cardinality question and a how-much question call for two very different kinds of answers. We have already seen that, since the answer to (71) is "four", there are four actual moons, revolving around Jupiter. The answer to (78) may also be "four": you want four spoonfuls of sugar in your coffee. But in the case of (78) --unlike that of (71)-- there is no corresponding paraphrase that begins with a numerically definite existential quantifier. The typical answer to (78), reading "want" in the notional sense, does not assert that you want four individual things of a certain kind in your coffee, e.g. four individual quantities of sugar in the right amount.⁵¹ Any quantity of sugar will do, as long as it is the right *amount* of sugar. (78) asks for an *amount* of sugar, not a number of quantities of sugar. Similarly, (79) asks what the *amount* of sugar, as measured in cupfuls, in that bowl

(71)'' How *much* moon of Jupiter, as measured in individual moons, is there?

(74)' How *much* real number, as measured in individual numbers, is there?

(77)' How *much* car, as measured in individual cars, did the factory produce today?

This difference is presumably due to the fact that the nouns "moon", "number" and "car" do not standardly have mass-occurrences, while "apple" and "hair" do.

⁵⁰ There is a reading of (75), according to which it is a genuine how-much question, just like (78) & (79):

(75)'' How *much* apple, as measured in, did you eat today?

where we are to substitute whatever salient measure we choose to, e.g. "pounds", "kilograms", etc.

⁵¹ For the notional/relational distinction, see Quine (1956).

is.⁵² In both (78) & (79), the noun "sugar" is functioning as part of the mass-predicate "is-sugar". Both questions ask for an amount of something of which the mass-predicate "is-sugar" is true.

In contrast, (75') still asks how many things of a certain kind there are, even though this might be obscured by the awkward paraphrase in (75'). This is just to say that "individual apple" is not a genuine measure of an amount in the way in which "spoonfuls of sugar" is. "How much apple, as measured in individual apples" is just another --more awkward-- way of saying "How many apples". "How much sugar, as measured in spoonfuls", on the other hand, does genuinely ask for an amount of sugar.

We now know roughly what the difference is between the two kinds of how-many questions with which we began: cardinality questions and how-much questions. Cardinality questions ask how many things of a certain kind there are. Their answers begin with a numerically definite or indefinite existential quantifier. How-much questions, on the other hand, ask for an amount of something, as measured in a certain way. Any particular quantity of whatever is in question will do, as long as it is the right amount.⁵³

⁵² For more discussion on measures of amount, see Helen Cartwright's "Amounts & Measures of Amount", in: Nous 9 (1975), pp.143-164.

⁵³ I do not mean to rule out a nominalistic analysis of amounts in terms of quantities. Such a reduction could conceivably utilize the notion of a partition of the maximal quantity in question into so-and-so many arbitrary non-overlapping quantities. For instance, the maximal quantity of sugar in my bowl is that quantity which comprises all the sugar in the bowl. If there are four cupfuls of sugar in my bowl, then one of the ways of partitioning the sugar in the bowl is to divide it into (any) four non-overlapping quantities (each of which is of the same amount as one cupful of sugar) which together add up to the maximal quantity. Whatever the merits of such an approach, it is quite compatible with the distinction between cardinality questions and how-much question, as drawn in terms of quantification over particular things of a certain kind. I am quite confident that there would still be a noticeable contrast between the four moons of Jupiter and the four cupfuls of sugar in the bowl.

What is it, fundamentally, that accounts for cardinality questions being cardinality questions and how-much questions being how-much questions? It is striking that all the cardinality questions we have looked at contain nouns that have count-occurrences (and do so standardly) and function semantically as part of a singular count-predicate (e.g. "is-a-hair", "is-a-moon", "is-a-number", "is-a-car", etc.). In contrast, all our examples of how-much questions contain nouns that have mass-occurrences (and do so standardly) and function semantically as part of a mass-predicate (e.g. "is-hair", "is-apple", "is-sugar", etc.).

Is it sufficient for a how-many question to be a cardinality question that the noun occurring after the words "how many" plays the role of a singular count-predicate? Recall the "Condition on Cardinality Questions" (CCQ) from the beginning of this section:

CONDITION ON CARDINALITY QUESTIONS:

A question of the form 'How many Fs are?' is a cardinality question only if the Fs are isolated by a singular count-predicate of the form 'is-an-F'.

The CCQ contains the requirement that the noun occurring after the words "how many" must play the role of a singular count-predicate. But the CCQ also says more than that. The singular count-predicate must also "*isolate*" what is in its extension. What does this qualification add?

The notion of isolation comes from the Grundlagen. Frege says in §44 of the Grundlagen that "[w]hat answers the question How many? is number, ...". Now we know that Frege's characterization is too crude. Not all how-many questions are cardinality questions (at least some are how-much questions) and only cardinality questions are associated with number in the way Frege must have had in mind. In §54 of the Grundlagen, Frege distinguishes among different sorts of concepts, only some of which he thought can be associated with number in the way he intended. He says:

Only a concept which isolates what falls under it in a definite manner, and which does not permit any arbitrary division of it into parts, can be a unit relative to a finite Number.

The group of concepts Frege meant to single out must satisfy two conditions. First, the right sort of concept must, as he puts it, "isolate what falls under it in a definite manner"; and, secondly, it must "not permit any arbitrary division of [what falls under it] into parts". I shall refer to Frege's two conditions as the "*isolation-criterion*" and the "*divisibility-criterion*".⁵⁴

§54 is extremely difficult and what I have to say about it will be very brief and cursory. Frege's examples in §54 of a concept which satisfies both isolation and divisibility are "letters in the word 'three'" and "syllables in the word 'three'":

The concept "letters in the word 'three'" isolates the "t" from the "h" from the "r", and so on. The concept "syllables in the word 'three'" picks out the word as a whole, and as indivisible in the sense that no part of it falls any longer under that same concept.

What are we to make of the isolation-criterion? The concept "letters in the word 'three'" passes the isolation-criterion: it isolates each letter in the word "three" from its environment in a definite manner. But what counts as the environment? Is it only the surrounding letters (or perhaps letters, in general)? Or is the environment the surrounding letters plus the rest of the world?

Given what we know from elsewhere, Frege wanted his concepts both to have sharp boundaries (exclusion of vagueness) and to be applicable across the board.⁵⁵ Thus, the

⁵⁴ I shall not attach much weight to Frege's talk of *finite* numbers. Given his examples in the *Grundlagen* --the four moons of Jupiter, the letters in the word "three", etc.--, he seems to have been thinking mostly of relatively small cardinal numbers. I am assuming, for instance, that "real number" would count as a perfectly fine Fregean concept. "Real number" certainly satisfies both of Frege's criteria, isolation and divisibility.

⁵⁵ *Nachgelassene Schriften*, p.152,195,229,241,243.

concept "letters in the word 'three'", on Frege's view, being the proper Fregean concept that it is, not only sharply delineates the 't' from the 'h'; it also sharply deliniates the 't' from the page and the book in which one of its tokens occurs, from the table on which the book is lying, from the person who owns the book, and so forth. In each case, it must be clear (to us? in itself?) whether or not a thing falls under the concept in question. The concept divides the domain of quantification into two halves: those things that fall under the concept and those things that do not.

But all that follows from the isolation-criterion directly, it seems, is the exclusion of vagueness. It is perfectly compatible with the isolation-criterion that the concept "letters in the word 'three'" says nothing one way or the other about planets or numbers. All the isolation-criterion demands is that it sharply delineate the "t" from the "h" from the "r" and so on. That is, the isolation-criterion only requires that the concept sharply delineates *among the things to which it is applicable*. To require concepts to be applicable across the board is an extra step.

The divisibility-criterion says that no arbitrary part of something which falls under the concept in question itself is to fall under the concept in question.⁵⁶ For example, the letter "t" falls under the concept "letters in the word 'three'" and the letter "t" has no part (no *proper* part) which itself falls under the concept. The whole word "three" falls under the concept "syllables in the word 'three'" and it has no (proper) parts which themselves fall under the concept. No *arbitrary* (proper) part? Here, Frege must have roughly the following in mind. A building, for instance, can be made up smaller buildings: proper parts of something that falls under the concept "building" can themselves fall under the concept. But not just any proper part of a building will fall under the concept "building": the windows will not, nor will the

⁵⁶ The divisibility-criterion is very close to the negation of homogeneity, except for the mentioning of *arbitrary* parts.

rooms, the doors, or the walls. Only certain very specific proper parts of a building, if any, will themselves fall under the concept.

Frege's example in §54 of a concept which fails the divisibility-criterion, interestingly, is "red":

We can, for example, divide up something falling under the concept "red" into parts in a variety of ways, without the parts thereby ceasing to fall under the same concept "red". To a concept of this kind no finite number will belong.

About this passage, Geach says:

Frege sagely remarked that in other cases, e.g. "red things", no finite number was determined. But of course the trouble about counting the red things in a room is not that you cannot make an end of counting them, but that you cannot make a beginning; you never know whether you have counted one already, because "the same red thing" supplies no criterion of identity.⁵⁷

And again:

...[T]here would be no question of telling whether there are as many red things in this room as nonred things; for there is no way of telling what is or is not the same red thing, there being no criterion of identity, and this is still more obvious for nonred things. On such cases, as we saw, Frege sagely remarks that the (concept signified by the) predicable determines no finite number; but the trouble is not that we cannot make an end to counting but that we could not even begin to set up a one-one correlation of the things counted to numerals.⁵⁸

What Frege should have said, according to Geach, is not that no *finite* number belongs to "red", or "red thing", (i.e. that we cannot *stop* counting), but that *no* number at all belongs to "red" (i.e. that we cannot even *begin* to count). Geach's diagnosis of what is wrong with the concept "red", such that *no* number belongs to it, is that it fails to supply us with what he calls

⁵⁷ Reference & Generality, Cornell University Press, 1962, p.63, §30.

⁵⁸ *Ib.*, p.177, §92.

a *criterion of identity*, a criterion by which we can tell whether something is *the same* red thing.⁵⁹

But how could something be a Fregean concept and *not* bring with it a criterion of identity? *All* Fregean concepts (even those that do not pass isolation and divisibility) divide up the domain of quantification into those things that fall under them and those that do not. And how could a concept do its job without there being some way of identifying what falls under it? In other words, for *any* Fregean concept (even those that fail isolation and divisibility), the following two questions must be well-defined.⁶⁰

FREGEAN CONCEPT - INDIVIDUATION:

For any object o in the domain of quantification and for any concept C , does o fall under C ?

FREGEAN CONCEPT - IDENTITY:

For any two objects o_1 & o_2 in the domain of quantification and for any concept C , where o_1 & o_2 both fall under C , is $o_1 = o_2$?⁶¹

What isolation adds to this is that the answer in both cases must be *precise*: for concepts that pass isolation, it must be clear both whether o_1 and o_2 fall under C and whether o_1 and o_2 are identical. Perhaps the best way to put this is in terms of truth-values:

FREGEAN CONCEPT - ISOLATION:

⁵⁹ Dummett, in FPL, seems to come down on the side of Geach: the whole sense of "red", as he would put it, lies in its principle of application; it fails to supply a principle of identity. (Cf. FPL, Harvard University Press, 1973, ch.16.)

⁶⁰ By "well-defined" I mean that the two questions must have *some* answer, though not necessarily a precise one.

⁶¹ It is disputed how we are to read "domain of quantification". Does it include absolutely everything, i.e. is unrestricted quantification possible? Or is all quantification restricted? For a defense of unrestricted quantification, see, e.g., Richard Cartwright (1994); for the opposing view, see, e.g., Michael Glanzberg (unpublished draft).

A concept C satisfies isolation iff, for any two objects o_1 & o_2 to which C is applicable, it is either true or false that o_1 is C , that o_2 is C and that $o_1=o_2$.⁶²

Given this picture, Frege does not seem to think of a criterion of identity (and individuation) as some *extra* asset that can or cannot attach to a concept. Rather, identity (and individuation) is built into the notion of a Fregean concept from the outset. What is an extra asset --and one that, in Frege's mind, must be present, if the concept is to be associated with number-- is to satisfy isolation and divisibility.

So when faced with Geach's question

(80) How many red things are there in the room?

we *can* begin to count, on Frege's view. The question is *not* incomplete. Frege's problem with (80) is that "red" (as well as "red thing") fails the divisibility-criterion. We can divide up the red thing, whatever it is, in a variety of ways and the result will still itself fall under the concept "red". (The "variety of ways" must be the division into *arbitrary* parts again from above.) In fact, Frege seems to think that we can go on like this forever; that is, he must be thinking that *every* part of something which falls under the concept "red" itself falls under the concept. Why else would he say that *no finite* number belongs to the concept "red"? And although Frege does not explicitly say so, "red" (or "red thing") presumably also fails the isolation-criterion. "Red" (and "red thing") does specify a criterion of identity, as all Fregean concepts do. However, like many ordinary concepts, "red" presumably does not have sharp boundaries: there will be cases where it is not entirely clear whether two objects fall under the concept "red" and whether they are identical.

⁶² The "either-or" is meant to be exclusive. Furthermore, there is also meant to be no third option, in addition to true and false. For someone who (like Frege) also endorses the universal applicability of concepts, the isolation clause will hold for any objects whatsoever.

Is Frege right? Is it really the case that only those concepts which satisfy his two criteria of isolation and divisibility can be associated with number in the right sort of way? As Cartwright points out, at least the second criterion seems to be misguided. There are plenty of concepts which *can* be associated with number in the form cardinality questions but which do not pass the divisibility-criterion. His examples are "string in the alphabet {'a','b'}" and "area in the UK". The string "abab" falls under the concept "string in the alphabet {'a','b'}", but so do all of its parts (if we allow for one-letter strings). Similarly in the case of "area in the UK". Hence, a proper Fregean concept need not satisfy divisibility.

What about the first criterion, the isolation-criterion? The first thing to note about isolation is that, for our purposes at least, it seems unnecessarily strong. Vagueness abounds in our ordinary discourse, but, in many circumstances, this does not seem to prevent us from successfully associating concepts with number in the way in which this is done in a cardinality question. We do not seem to have too much trouble with questions like "How many children are there in the room?", even though the concept "child" (as well as "in the room") has some borderline cases, where it is indeterminate whether the person in question should still count as a child. Of course, too much vagueness will obstruct counting. If all the people in the room are about sixteen years old and, moreover, are placed exactly under the doorframe, then we will have to clarify a few things first, before we can assign a cardinal number to the concept "children in the room". Still, it is usually enough for counting if there are *some* clear cases. The rest we can argue about. If, besides the sixteen-year-olds under the doorframe, there are also a five-year-old and a ten-year-old, placed conveniently in the center of the room, we might answer the question "How many children are there in the room?" tentatively with "Two clear cases and I don't know about the ones under the doorframe". The upshot of this first

comment, then, is that Frege's isolation-criterion is too strong for our ordinary purposes. We might weaken it roughly as follows:

WEAKENED ISOLATION:

A concept *C* satisfies weakened isolation iff, for sufficiently many objects o_1 & o_2 to which *C* is applicable, it is either true or false that o_1 is *C*, that o_2 is *C*, and that $o_1 = o_2$.

Weakened isolation leaves it open what counts as "sufficiently many" in each particular case.

And this, I think, is exactly as it should be, since expectations will differ from concept to concept and also from context to context.

My second comment concerning Frege's isolation-criterion is that, as it stands, it is not precise enough to do the work it is intended to do. A concept passes Frege's isolation-criterion (plus universal applicability) if it clearly divides the domain of quantification into two halves: those things that fall under it and those that do not. But now consider again some of our examples of how-many questions which were *not* Fregean cardinality questions:

(78) How many spoons of sugar do you take in your coffee?

(79) How many cups of sugar are in that bowl?

The concept "sugar" or (or "amount of sugar as measured in ...") also passes the isolation-criterion. With respect to everything in the domain of quantification, it is possible to say (with as much clarity as in the case of "moon of Jupiter") whether it falls under the concept or not, i.e. whether it is sugar or not. The concept "sugar" also divides up the domain of quantification into two halves: sugar and non-sugar. (Of course, "sugar" does not pass the divisibility-criterion; but Cartwright's examples have shown that Frege cannot hold on to the divisibility-criterion in any case.)

What Frege needs to say, then, is that a Fregean concept must pass the isolation-criterion *in a certain way*. I would like to suggest that a Fregean concept must isolate what

falls under it in the way in which a *singular count-predicate* isolates what is in its extension. For recall that it was a striking feature shared by all cardinality questions that the noun occurring after the words "how many" plays the role of a singular count-predicate, and not that of a mass-predicate. A singular count-predicate of the form 'is-an-F' isolates its extension in such a way that everything that falls under it is *an F*, i.e. *one whole individual F*. Now we have derived the CCQ in its full form:

CONDITION ON CARDINALITY QUESTIONS:

A question of the form 'How many Fs are?' is a cardinality question only if the Fs are isolated by a singular count-predicate of the form 'is-an-F'.

This condition should not be surprising. We knew from the start that there was some connection between singular count-predicates and cardinaly number. In fact, the reader might be somewhat annoyed that it took me so many pages to tease out what this connection amounts to. However, I hope it turned out to be at least somewhat instructive to look more closely at questions like "How many red things are there in the room?", and to touch on the topic of vagueness and division into arbitrary parts.

But there is still one group of how-many questions which deserve special attention. I have in mind questions of the following form:

- (81) How many sugars do you take in your tea?⁶³
- (82) How many golds are there on the table?

Given current usage, there is something non-standard about (81) & (82). Clearly, the oddity of (81) & (82) must have something to do with the fact that "sugar" and "gold" standardly have mostly mass-occurrences, whereas their occurrence in (81) & (82) is a count-occurrence. This

⁶³ Actually, I have been told that (81) is fine in British English. Nevertheless, most Americans seem to find it quite non-standard.

creates a tension: because there is no salient explicit or implicit measure-phrase (like the "cups of" or "spoons of" in (78) & (79)), we are tempted to interpret (81) & (82) as a regular cardinality question; but because these nouns typically have only mass-occurrences, it is not clear what we are supposed to be counting.

Suppose we interpret (81) & (82) as cardinality-questions. Then, the noun specifying what the cardinality question is about must play the semantic role of a singular count-predicate. That is, we must read the nouns "sugar" and "gold" as playing the role of "is-a-sugar" and "is-a-gold". But what are to count as *a* sugar and *a* gold? In (81), it might be little sugar *packets*; in (82), it might be *kinds* of gold or *clumps* of gold or some other contextually salient unit. That is, in order to interpret (81) & (82) as a cardinality-question, we must fill the blanks in

- (81)' How many of sugar do you take in your tea?
(82)' How many ____ of gold are there on the table?

There is no one conventionally accepted way of interpreting (81) & (82) as a cardinality question, as there would be in the case of, say, "beer". In fact, if there were such a conventionally established way, we would presumably no longer find (81) & (82) so odd. As it is, we have to make up our minds on the spot and supply whatever unit we think fits the best in the context at hand.⁶⁴

⁶⁴ It is important to note that the non-standardness of (81) & (82) has nothing to do with the fact that sugar and gold are stuff-like. We would be faced with similar difficulties in the case of

- (83) How many asparaguses would you like?

even though asparagus comes in nice spear-shaped units. (To some ears, (83) sounds much worse than (81) & (82). But, according to the perspective employed here, all this means is that (83) is *more* non-standard than (81) & (82): the notion of non-standardness is one of degrees. It does not mean that (83) is of a different kind.)

The other way of construing (81) & (82) is as how-much questions, that is as

(81)'' How much sugar do you take in your tea?

(82)'' How much gold is there on the table?

Of course, no one in their right mind would ask how many sugars and how many golds are such-and-such, if what they really wanted to ask was how *much* sugar and how *much* gold are such-and-such. But the question now is what we would do if we were confronted by (81) & (82), regardless of why anyone would want to pose such questions.

(81'') & (82'') sound much more natural than (81) & (82). Now "sugar" and "gold" have mass-occurrences, as they standardly do. But, again, we need to supply something to turn (81'') & (82'') into how-much questions that we can answer: we need to supply some contextually salient measure of amount. (81'') & (82'') ask for an amount of sugar and gold, but we have not been told what would be an acceptable measure. Before we did not know what we were supposed to count; now we do know what we are supposed to measure, namely sugar and gold, but we have not been shown how to measure it. To complete (81'') & (82''), we need to fill in the blank in (81''') & (82'''):

(81''') How much sugar, as measured in, do you take in your tea?

(82''') How much gold, as measured in _____, is there on the table?

In (81'''), the most salient measure might be spoonfuls; in (82'''), it might be lumps of a certain weight.

Let me briefly summarize what I have established in this section. Just as we might have expected, there is a connection between nouns that have count-occurrences and counting or, more generally, cardinal number. If we want to associate the world's hair in some way or other with *number*, we need to speak of it (them?) in terms of individual hairs, i.e. those things

of which the singular count-predicate "is-a-hair" is true. If, on the other hand, we are interested in *amounts* of hair, we need to speak of the world's hair as plain hair. Hair could be individual hairs, hair-parts or hair-sums. But how we choose to speak --"hair" versus "a hair"-- need not reflect a difference in what is actually floating around in our soup. This suggests a metaphysical position that endorses neither the Fregean nor the Geachian outlook. Perhaps, there is a viable metaphysical middleground, according to which the world comes neither already divided up into Fregean objects nor as undifferentiated Geachian stuff. We can sometimes talk about the very same thing or things in a mass-way or in a count-way. Accordingly, we must conceive of the world in such a way as to allow for both kinds of talk.

6. **"Is-True-Of" Relation**: Now, despite their differences, there is also something which these two kinds of predicates have in common. The relation "is-true-of" appears in both (SCP) & (MP):

(SCP) **SINGULAR COUNT-PREDICATE**:

"Is-a-hair" is true of x iff x is a (one) hair.

(MP) **MASS-PREDICATE**:

"Is-hair" is true of x iff x is hair.

It is my contention that the relation "is-true-of" which appears under the heading "Mass-Predicate" not only *looks* the same as the one which appears under the heading "Singular Count-Predicate": it *is* one and the same relation. Both mass-predicates and singular count-predicates are *predicates*, only predicates of a different kind. What makes them different is that singular count-predicates contain the indefinite article, while mass-predicates do not. And we have discussed two ways in which the presence or absence of the indefinite article makes itself felt: cardinality questions and Homogeneity. However, both kinds of predicates play *the*

same semantic role, namely that of a predicate. All predicates are related to what falls into their extension, in such a way that they *are true of* all and only what falls into their extension. The relation "is-true-of" holds between a predicate and everything that falls into its extension (and nothing else). To be related to its extension in this way is just what it means to be a predicate. This is the case for mass-predicates and singular count-predicates alike. Both are true of everything that falls into their extension and nothing else.

To summarize, the two kinds of predicates we have distinguished have something in common and they are also related in a certain way. What they have in common is that both play the same semantic role, namely that of a predicate. They are related to one another by a one-way entailment, to the effect that a mass-predicate 'is-N' is true of everything of which the singular count-predicate 'is-an-N' is true, but not vice versa.

There are two important differences between mass-predicates and singular count-predicates. First, mass-predicates appear to be homogeneous, i.e. they appear to be true of all parts and sums of things of which they are true. Singular count-predicates, on the other hand, are not homogeneous; they are true of all and only whole individual things of a certain kind. They are not true of the parts and sums of things of which they are true.

Secondly, we noted that there is some connection between singular count-predicates and counting. When we are interested in associating things with cardinal number (in the way in which this is done in a cardinality question), we need to avail ourselves of the corresponding singular count-predicate, rather than the mass-predicate. The mass-predicate comes in handy when we are interested in amounts (as expressed in how-much questions), rather than cardinal number. This difference, however, appears to be not so much a metaphysical difference, but rather a difference in the way we talk. It is entirely possible to

speak about the very same thing in a mass-way or in a count-way, whatever is more appropriate at the time.

7. Two Alternative Views: We have so far only mentioned *semantic* differences between mass-predicates and singular count-predicates. But one might think that this semantic characterization does not yet capture the heart of the matter. Perhaps, the real contrast between these two kinds of predicates is not semantic, but *ontological* in nature. In what follows, I discuss two alternative ways in which the contrast between these two kinds of predicates is often characterized in the literature. The first of these, I shall argue, is in fact not a viable alternative characterization: it does not properly capture the contrast between mass-predicates and singular count-predicates at all. The second of these, on the other hand, differs from the semantic characterization of the previous section only terminologically. However, even though these two characterizations are only terminological variants of each other, the semantic characterization is, I think, still preferable, simply because the terminology in which it is cast is more straightforward.

It is often suggested that the difference between a mass-predicate like "is-water" and a singular count-predicate like "is-a-man" is ontological in nature. The world, according to this view, consists of at least these two different kinds of entities: *stuffs* and *things*. The extension of mass-predicates is made up of bits of stuff. The extension of singular count-predicates, on the other hand, is made up of things. Water is a kind of stuff and the extension of the mass-predicate "is-water" consists of particular instances of the stuff water. The extension of the

singular count-predicate "is-a-man", on the other hand, consists of things of a particular kind.

A man is a kind of thing and not a bit of stuff.⁶⁵

But this proposal is neither plausible nor helpful. First of all, if an analysis of the mass/count distinction is to make serious use of the notions stuff and thing, these would need to be delimited in some way. What exactly is to count as a stuff and what is to count as a thing? Given our vague usage of the terms "stuff" and "thing", this would already be a hard task. But let's, for the moment, assume that the terms "stuff" and "thing" can be made precise enough to be philosophically useful. Even given this assumption, an analysis along these lines is nevertheless not promising. For the distinction between mass-occurrences and count-occurrences of nouns does not seem match up with our intuitive distinction between stuffs and things.

First of all, only a handful of nouns which standardly have mass-occurrences apply to something we would consider "stuff-like". Nouns like "furniture", "footwear", "equipment", "hardware", "money", "music", "non-sense", and "work" standardly have mass-occurrences, but we presumably would not want to say that they apply to something "stuff-like". Burge, for instance, is someone who acknowledges that these nouns intuitively do not seem to apply to something "stuff-like". Yet, he still maintains that the mass/count distinction corresponds, at least roughly, to our intuitive distinction between stuffs and things:

The match between our rough linguistic distinction and the intuitive thing-stuff distinction is not exact. Not all mass terms are intuitively true of stuffs. "Fruit", "clothing", "apparatus", "hardware" are not. Some expressions which intuitively do, at least sometimes, apply to stuffs are not mass terms --"quantity", "aggregate", and perhaps "part" and "piece". Still, the parallel between the distinctions is close enough to warrant the view that by giving a formal theory of sentences containing typical

⁶⁵ This view is, I think, tacitly or overtly present in a large number of writings on this subject. I list only a few: Burge (1975), Chierchia (1982), Link (1983), Schubert & Pelletier (1987).

count nouns and mass terms, one will also be clarifying the logical and ontological content of the intuitions about stuffs and things which we have inherited from childhood and our philosophical tradition.⁶⁶

Consider also the nouns "asparagus" and "carrot". "Asparagus" standardly has only mass-occurrences; "carrot", on the other hand, standardly has count-occurrences. However, I cannot see any ontological differences between asparagus and carrots, such that one would be more "stuff-like" than the other. Asparagus and carrots are, it would seem, sufficiently similar in appearance and in what role they play in our lives, that it would be just as easy for "asparagus" to have count-occurrences as it is for "carrot".

Furthermore, there is a considerable degree of variation among different languages, as to what kinds of occurrences a noun can have. Thus, the English noun "fruit" standardly has only mass-occurrences. The same word in German ("Frucht"), on the other hand, standardly has only count-occurrences. But would we really want to say that "fruit", to a speaker of English, applies to something "stuff-like", while the corresponding German word applies to something "thing-like"?

Finally, there is a large group of nouns which standardly have both mass and count-occurrences, e.g. "hair", "beer", "chicken", and the like. In fact, as was observed in chapter III., every noun which standardly has mass-occurrences can also have count-occurrences, meaning, for instance, "a kind of ...". It seems quite implausible to say that the same noun applies to something "stuff-like", when it has a mass-occurrence, and to something "thing-like", when it has a count-occurrence. Take the noun "hair". When "hair" has a mass-occurrence and functions semantically as part of the mass-predicate "is-hair", it is true of all and only hair. When "hair" has a singular count-occurrence and functions semantically as part

⁶⁶ Burge (1975), p.459.

of the singular count-predicate "is-a-hair", it is true of all and only whole individual hairs. But we can talk about the hair in my soup --the very same entity-- either as just plain hair or *a* hair (or hairs). It therefore seems wrong to say that there is something of a different ontological type in my soup, depending on whether we choose to talk in a mass-way or in a count-way.

Let's now turn to the second characterization of the contrast between mass-predicates and singular count-predicates. According to this view, the difference between these two kinds of predicates is that they "*individuate*" their extension differently (or, in Quine's terminology, "*divide their reference*" differently). The mass-predicate "is-hair" individuates (divides its reference over) the world's hair in one way; the singular count-predicates "is-a-hair" individuates (divides its reference over) the world's hair in some other way.⁶⁷

Now, the term "individuation" is used in many different ways and to bring out more precisely what it is taken to mean, in this particular context, would lead us too far astray. (The same applies to Quine's "divided reference".) Nevertheless, it seems that this way of expressing the contrast between mass-predicates and singular count-predicates really does not add anything to the semantic characterization given in the previous section. The singular count-predicate "is-a-hair" presumably individuates the world's hair into whole individual hairs, as opposed to hair-parts and hair-sums. The mass-predicate "is-hair", on the other hand, individuates the world's hair differently.⁶⁸ "Is-hair" individuates the world's hair into

⁶⁷ E.g. Cartwright (1970), p.25ff; Bunt (1975), p.256; Boolos (1984), p.449.

⁶⁸ Of course, some (e.g. Quine) would deny that "hair", in its mass-occurrences, individuates (divides its reference over) the world's hair at all. But someone who holds this position is a supporter of the name-view and we are now only concerned with different versions of the predicate-view.

particular hair-quantities. A tuft of hair is a quantity of hair, and so is a bunch of hair, a bundle of hair, a cluster of hair, and a collection of hair. What tufts, bunches, bundles, clusters and collections of hair have in common is that each of them is *some* hair. (Of course, *one* hair is also *some* hair. But not everything that is *some* hair is also *one* hair.) Thus, the mass-predicate "is-hair" individuates the world's hair into particular hair-quantities, each of which it *some* hair.

But this way of characterizing the contrast between mass-predicates and singular count-predicates is not different in substance from the one given in the previous section. To say that the singular count-predicate "is-a-hair" individuates the world's hair into whole individual hairs, as distinct from hair-parts and hair-sums, is just to replace talk of truth in by talk of individuation. Similarly, to say that the mass-predicate "is-hair" individuates the world's hair into hair-quantities, each of which is some hair, is nothing more than a terminological variant of my rule governing mass-predicates, "is-hair" is true of x just in case x is hair.

To conclude, it appears that the semantic characterization of the contrast between mass-predicates and singular count-predicates does get to the heart of the matter after all. We have just looked at two alternative characterizations. The first claims that mass-predicates are different from singular count-predicates, in that the former are true of instances of a kind of stuff, while the latter are true of things of a certain kind. But our intuitive distinction between stuffs and things does not match the distinction between mass-predicates and singular count-predicates. The second characterization merely replaces "truth" with "individuation" (or "divided reference"). It is therefore nothing more than a terminological variant, and perhaps a less fortunate variant, of the semantic characterization.

8. Relativized Parthood: I would now like to return to what I referred to above as "the first difference" between mass-predicates and singular count-predicates. The first difference was the following. Singular count-predicates were characterized as non-homogeneous, because they are not true of all the parts and sums of things of which they are true. Mass-predicates, on the other hand, were characterized as homogeneous; they appear to be true of all the parts and sums of things of which they are true.

But we need to be more precise. There is no such thing as a unique parthood-relation; "is-a-part-of" can be used in many different ways.⁶⁹ The property of homogeneity was defined as a conjunction of two properties, distributivity and cumulativity. The property of distributivity makes explicit reference to parts. Whether or not mass-predicates really are homogeneous depends crucially on how we construe "is-a-part-of".

Suppose we define "is-a-part-of" in the way proposed in Leonard & Goodman's Calculus of Individuals.⁷⁰ The Calculus of Individuals assumes one primitive relation, "is-discrete-from" (abbreviated "I"), and defines the relations "is-a-part-of" (" $<$ "), "is-a-proper-part-of" (" $<<$ ") and "is-the-sum-of" ("Su") in terms of discreteness as follows:

PART:

$$x < y \equiv \forall z [z < y \rightarrow z < x]$$

PROPER PART:

$$x << y \equiv x < y \ \& \ x \neq y$$

SUM:

⁶⁹ For a contrary view, see Lewis (1991).

⁷⁰ Leonard & Goodman (1940).

$$\text{Su}(x, \alpha) \equiv \forall y [y|x \equiv \forall z [z \in \alpha \rightarrow y|z]]^{71}$$

According to the Leonard-Goodman view, x is a part of y just in case everything that is discrete from y is also discrete from x . A proper part of something y is a part of y that is not identical to y . An individual x is the sum of a class α just in case everything that is discrete from every member of α is also discrete from x and everything that is discrete from x is also discrete from every member of α .

The relation "is-a-part-of", according to the Calculus of Individuals, has the following properties:

TRANSITIVITY:

$$x < y \ \& \ y < z \rightarrow x < z$$

REFLEXIVITY:

$$x < x$$

ANTI-SYMMETRY:

$$x < y \ \& \ y < x \rightarrow x = y$$

Now, the Leonard-Goodman view narrows down only slightly the wealth of different possible interpretations of the parthood-relation. By accepting the Leonard-Goodman axioms, we have at least ruled out certain ways of reading "is-a-part-of". We have, for instance, ruled out those views according to which parthood is, say, an intransitive relation.⁷² However, the relation "is-discrete-from" (in terms of which parthood is defined) allows for many different interpretations as well (perhaps as many as the relation "is-a-part-of" itself?). For instance, "is-

⁷¹ For our purposes, only the definitions and axioms governing "is-a-part-of", "is-a-proper-part-of" and "is-the-sum-of" are relevant. In addition to these, the Calculus of Individuals contains two more relations: "overlaps" and "is-the-nucleus-of". For further details, see, e.g., Leonard & Goodman (1940), Eberle (1970), Simons (1987).

⁷² See, for instance, Moltmann (1992) for a treatment according to which parthood is neither extensional nor transitive.

discrete-from" could be taken as a spatial relation. But this is only one possibility. Surely, there are others (e.g. temporal discreteness), especially since one of the features on which Calculus of Individual prides itself is its wide range of applications.

So the Leonard-Goodman view does not provide us with a single interpretation of the parthood-relation either. In order to narrow down the different possibilities, we would need to impose further specifications, depending on the particular purpose at hand. However, what is important for our present purposes is that the parthood-relation, as defined by the Calculus of Individuals, clearly admits of interpretations according to which most mass-predicates turn out *not* to be distributive. (In fact, as we will discover shortly, it is hard to see how it could be interpreted in any *other* way.) For the mass-predicate "is-water" to be distributive, it would have to be true of *all* of the parts of something of which it is true. Suppose "is-water" is true of the liquid in this glass. Is "is-water" also true of *all* parts of the liquid in this glass? "Is-water" is certainly true of half of the liquid in this glass, a fourth of it and every drop of it. Thus, "is-water" is true of at least *some* of the parts of the liquid in this glass. But what about the individual hydrogen and oxygen atoms? Taking discreteness as a spatial relation, these atoms are *part* of the water in this glass. For everything that is spatially discrete from the liquid in this glass is also discrete from every hydrogen and oxygen atom contained in it. But the mass-predicate "is-water" is not true of individual hydrogen and oxygen-atoms. An individual hydrogen-atom is not itself water. Moreover, "is-water" is not a special case. On this reading of "is-a-part-of", most mass-predicates are not distributive.⁷³

Perhaps, distributivity should be weakened in the following way:

⁷³ In fact, there are almost no predicates at all, with the possible exception of "is-spatially-extended" and "is-temporally-extended", which satisfy distributivity, on this reading of "is-a-part-of".

WEAKENED DISTRIBUTIVITY:

A predicate Φ is *weakly distributive* iff Φ is true of *some* of the proper parts of something of which it is true.

The trouble with this weakened version of distributivity is that it also holds of some singular count-predicates. For instance, the singular count-predicate "is-a-cloud" can sometimes also be true of parts of something of which it is true. Clouds can be made up of smaller clouds. Similarly, David Wiggins' example from Sameness & Substance: "is-a-crown" is true of the Pope's crown. But the Pope's crown is itself made up of many crowns. Thus, in the case of the Pope's crown, the singular count-predicate "is-a-crown" is also true of some of the parts of something of which it is true.⁷⁴ Weakened distributivity is therefore too weak to establish a contrast between mass-predicates and singular count-predicates.

It thus looks as though something must be added to the Leonard-Goodman axioms, if mass-predicates are to be distributive. In order for mass-predicates to satisfy distributivity, it must be the case that *every* part of something that is Φ is itself Φ . Consider the predicate "is-water". If the predicate "is-water" is to be distributive, we must add something to the Leonard-Goodman definition of parthood, such that individual hydrogen and oxygen-atoms are somehow ruled out as potential parts of water. Otherwise, there will be something that counts as a part of water of which the predicate "is-water" is not true.

But what counts as still big enough or too small to be Φ will be different for different predicates Φ . "Is-hydrogen", for instance, is different in this respect from "is-water". "Is-water" is not true of individual H-atoms: they are too small to be themselves water. "Is-hydrogen", however, is true of individual H-atoms. Thus, if all mass-predicates are to satisfy

⁷⁴ Wiggins (1980), p.73.

distributivity, we need to state distributivity in such a way that it contains a separate, relativized parthood-relation for each predicate Φ .

The first strategy that comes to mind, of course, is to relativize parthood in the following way:

RELATIVIZED PARTHOOD - First Attempt:

x is a Φ -part of y iff x is a part of y & x is Φ .

This added rule works fine: it rules out exactly what we want to exclude and leaves everything else alone. It rules out the individual H-atoms (i.e. they do not count as water-parts of something that is water), because they do not themselves count as water. But everything that is itself water naturally a water-part of water.

Unfortunately, though, the first attempt must be discarded; for the simple reason that it makes distributivity trivial. For imagine substituting the new, relativized notion of parthood into the definition of distributivity:

RELATIVIZED DISTRIBUTIVITY - First Attempt:

A predicate Φ is *distributive* iff Φ is true of any Φ -part of something of which it is true.

Of course, "is-water" is true of every water-part of something of which "is-water" is true. It is built into the definition of relativized parthood that the Φ -part itself still be Φ .

So let's move on to a more sophisticated notion of relativized parthood. I will first introduce the notion of an atomic Φ -part:

RELATIVIZED ATOMIC-PARTHOOD:

For any predicate Φ , x is an *atomic Φ -part* of y iff

- (i) Φ is true of x
- (ii) Φ is true of y
- (iii) x is a part of y

(iv) there is no proper part z of x , such that Φ is true of z .⁷⁵

On the basis of the relation "is-an-atomic- Φ -part-of", the relation "is-a- Φ -part-of" can now be defined as follows:

RELATIVIZED PARTHOOD - Second Attempt:

For any predicate Φ , x is a Φ -part of y iff

- (i) either x is an atomic Φ -part of y
- (ii) or x is the sum of atomic Φ -parts of y .

We can now reformulate distributivity in the following manner:

RELATIVIZED DISTRIBUTIVITY - Second Attempt:

For any predicate Φ , Φ is *relatively distributive* iff

- (i) Φ is true of *some proper* Φ -parts of something of which it is true, and
- (ii) Φ is true of *all* Φ -parts of something of which it is true.⁷⁶

Clause (ii) is just like our previous formulation of distributivity, except in that "is-a-part-of" has now been replaced by the relativized "is-a- Φ -part-of". The existential clause (i)

⁷⁵ The definition of relativized atomic parthood (as well as that of relativized parthood below) still contains an unrelativized parthood-relation, which can, for instance, be defined in the manner of the Calculus of Individuals.

⁷⁶ It was pointed out to me that "is-water" would fail to be relatively distributive in a world in which there exists only a single H_2O -molecule. Clause (ii) would be satisfied, since "is-water" would be true of all water-parts of something of which it is true, the only water-part being the H_2O -molecule itself. Clause (i), however, would not be satisfied, since "is-water", in this world, would not be true of any proper water-parts of something of which it is true. The only thing of which it is true is the single H_2O -molecule and none of its proper parts are water-parts.

Even though a world which only contains a single H_2O -molecule might strike us as slightly eccentric, it is certainly possible (in a stronger sense of "possible" than "logically possible"). For this reason, the single H_2O -molecule scenario certainly makes a certain amount of trouble for the formulation of relativized distributivity offered above. However, as we shall see shortly, relativized distributivity has other worrisome features, which might lead us to reject it independently of this particular counter-example.

rules out singular count-predicates from satisfying relativized distributivity. Without this clause, all singular count-predicates would satisfy relativized distributivity trivially. Consider the singular count-predicate "is-a-man". According to our definition of "is-an-atomic- Φ -part", Socrates would count as an atom with respect to the singular count-predicate "is-a-man". For Socrates is a part of himself and "is-a-man" is true of him. Moreover, Socrates has no proper parts of which "is-a-man" is true. Thus, Socrates is an atomic man-part of himself. Since he is an atomic man-part of himself, he is therefore also a man-part of himself, since he satisfies the first disjunct of "is-a-man-part" (atomic man-parts are man-parts). Without the addition of clause (i), "is-a-man" would therefore count as relatively distributive, since it is true of all the man-parts of something of which it is true.

Let's now consider cumulativity. A predicate Φ is cumulative just in case it is true of any *sum* of things of which it is true. This property certainly holds of "is-water". Suppose "is-water" is true of the liquid in these two glasses; then it is also true of their sum. If we take the sum of the contents of both glasses, we are still left with something of which the predicate "is-water" is true. But do all mass-predicates satisfy cumulativity?

According to Helen Cartwright, there are some counter-examples to the generalization that all mass-predicates are cumulative.⁷⁷ One might, for instance, think that "is-gold-that-weighs-two-grams" is an example of a non-cumulative mass-predicate. At first sight, "is-gold-that-weighs-two-grams" certainly looks like a perfectly good mass-predicate. It is true of something *x* just in case *x* is gold that weighs two grams. It therefore functions exactly like "is-hair" did in (68.a). The difference between "is-gold-that-weighs-two-grams" and "is-hair" is that the former is not cumulative, while the latter is. "Is-gold-that-weighs-two-grams" is not

⁷⁷ Helen Cartwright (forth), p.33 ff.

cumulative, because the sum of some gold that weighs two grams and some other gold that weighs two grams is gold that weighs *four* grams. Other apparent counter-examples to cumulativeness can be constructed in similar ways: "is-furniture-that-two-men-can-carry", "is-water-that-fills-one-bucket", etc.

One possible response to Cartwright's examples is to say that predicates like "is-gold-that-weighs-two-grams" are not genuine mass-predicates. Perhaps, "is-gold-that-weighs-two-grams" is actually a conjunction of two predicates: "is-gold" and "weighs-two-grams". "Is-gold" is a genuine mass-predicate, but "weighs-two-grams" is not. And whenever a genuine mass-predicate is conjoined with a predicate that is not a genuine mass-predicate, the resulting predicate is not a genuine mass-predicate. Of course, this seems slightly ad hoc and Cartwright's apparent counter-examples will ultimately require a more systematic response.⁷⁸

Let me briefly summarize what we have established in this section. We have seen that, according to a very natural reading of the parthood-relation (namely one governed by the Leonard-Goodman axioms, where discreteness is understood spatially), most mass-predicates turn out *not* to be distributive. In order for mass-predicates to satisfy distributivity, something must be added to the Leonard-Goodman axioms. One option is to reformulate distributivity in

⁷⁸ "Is-dust" was also suggested to me as a possible counter-example to the cumulativeness of mass-predicates. Perhaps, it is part of the meaning of "dust" that dust must be scattered around in a relatively thin film. Enormous quantities of the same stuff we call "dust" when dispersed might rather be called "dirt" or something along those lines. I find this example quite intriguing. Still, its force, I think, relies on a common mistake concerning summation. When we consider the sum of two things, we are not supposed to imagine those two things *actually* glued together in some mysterious way. Exactly what we *are* supposed to imagine depends on the way discreteness is understood. If we understand discreteness spatially, then the sum of the class containing the two things in question is simply that entity which is spatially discrete from everything from which the two things are discrete and conversely. But this operation in no way requires the two things in question to be themselves spatially connected.

such a way that it contains a separate, relativized notion of parthood for each predicate Φ , defined in terms of atomic parts and sums thereof. In the case of cumulativity, it did not seem to be necessary to relativize the relation "is-the-sum-of". However, we did encounter some apparent counter-examples to the generalization that all mass-predicates are cumulative, which need to be accounted for in a systematic way.

9. Relativized Parthood & Anti-Reductionism: Many writers on the subject would not find the relativized notion of parthood defined above very attractive. One of its controversial features is that it makes a reduction of statements containing (what intuitively look like) mass-predicates to statements of mereology impossible.

I have been assuming all along that there is nothing mysterious about mass-predicates. A competent speaker knows under what conditions a mass-predicate is true of something, to the same extent as he knows under what conditions a singular count-predicate is true of something. But this assumption is not always granted. Mass-predicates are generally thought of as something mysterious, ideally to be reduced to something better-understood. There are two candidates for this reduction: singular count-predicates and mereology. Both of these are taken to be relatively well-understood.

The first kind of reduction --the reduction of mass-predicates to singular count-predicates-- is already familiar from Burge. For Burge, mass-predicates are really (singular or plural) count-predicates in disguise. Thus, (55.a) gets reduced to either (55.b) or (55.c):

- (55) a. This is hair.
- b. This is a hair.
- c. These are hairs.

The second kind of reduction --the reduction of statements containing (what intuitively look like) mass-predicates to statements of mereology-- is a particular version of the name-view. According to this version of the name-view, every statement of the form '...is-N' (where the noun N has a mass-occurrence and appears to function as part of a predicate) can be reduced to a statement of the form '...is-a-part-of N' (where N is now playing the role of a name). Let's look at the second kind of reduction again more closely.

There are two possible ways of reducing statements containing (what look intuitively like) mass-predicates to statements of mereology. One option is to leave parthood unrelativized; the other is to relativize parthood in the way we have done above, or some similar way. Neither option works as a reduction of statements containing mass-predicates to statements of mereology.

If the parthood-relation is left unrelativized, then we run into what is often referred to as "the problem of minimal parts". Not every part of something that is Φ is itself Φ : some parts are too small to be themselves Φ .⁷⁹ If, on the other hand, the parthood-relation is relativized, then the supposed reduction will be question-begging. A statement of the form 'x is water' cannot be reduced to a statement of the form 'x is-a-water-part-of water' (where "water", in its second occurrence, is now playing the role of a name). For the relation "is-a-water-part-of" itself contains a predicative use of the noun "water". Something x is a water-part of something y just in case x is either an atomic water-part or x is the sum of atomic water-parts. And x is an atomic water-part of y just in case x is a part of y (in the unrelativized sense of parthood), the mass-predicate "is-water" is true of both x and y, and x has no proper parts (in the unrelativized sense of parthood) of which the mass-predicate "is-

⁷⁹ It might be objected that I have dismissed the first option too quickly. Perhaps, the problem of minimal parts is not as bad as it appears at first sight. For more on this issue, see my discussion of the question of atomicity below.

water" is true. It is obvious that this will not do as a reduction of statements containing (what look intuitively like) mass-predicates to statements of mereology.

10. Relativized Parthood & Atomicity: The relativized notion of parthood is also controversial in another respect. It commits us to the claim that the extension of all mass-predicates Φ consists of Φ -atoms and sums thereof. Something is a Φ -atom, if it satisfies the following conditions:

RELATIVIZED ATOMICITY:

x is a Φ -atom with respect to some predicate Φ iff

- (i) Φ is true of x and
- (ii) x has no proper parts of which Φ is true.

To illustrate, Socrates would be an atom with respect to the singular count-predicate "is-a-man". "Is-a-man" is true of Socrates and Socrates has no proper parts of which "is-a-man" is true.

The relativized notion of parthood commits one to the claim that the extension of all mass-predicates Φ consists of Φ -atoms (and their sums) for the following reason. For something x to be a Φ -part of something y , x must be either an atomic Φ -part or the sum of atomic Φ -parts. If x is an atomic Φ -part of y , then x is itself an atom with respect to the predicate Φ . For x to be an atomic Φ -part of y , it must be the case, among other things, that Φ is true of x and that x has no proper parts of which Φ is true. But, given the definition of " Φ -atom", this is just what it means to be an atom with respect to Φ . If, on the other hand, x is the sum of n atomic Φ -parts, we are still committed to the assumption that the extension of the predicate Φ includes Φ -atoms. For any atomic Φ -part is itself a Φ -atom and x is the sum of n

such atomic Φ -parts. Thus, either way, we are committed to the assumption that the extension of Φ consists of Φ -atoms (and their sums).

Why should the commitment to atoms in the extension of mass-predicates be controversial? The corresponding commitment in the case of singular count-predicates is not under dispute. There is no doubt that the extension of singular count-predicates consists of atoms. The atoms with respect to the singular count-predicate "is-a-man", for instance, are just the individual men like Socrates.

But mass-predicates are supposed to be different. It is thought to be a characteristic of mass-predicates that their extension precisely does *not* consist of atoms (and sums thereof).⁸⁰ But suppose this were the case. Then, for any mass-predicate Φ , if Φ is true of x , then there could be no y , such that y is a proper part of x and Φ is not true of y . In other words, if "is-water" is true of the liquid in this glass, then "is-water" would also have to be true of *all* of the parts of the liquid in this glass, down to the individual hydrogen and oxygen-atoms and further.⁸¹ But, given common linguistic practice, it is simply false that the predicate "is-water" is true of individual oxygen and hydrogen-atoms or their parts, protons and electrons and whatever else. Perhaps, a single H₂O-molecule is the smallest part of the water in this glass of which the predicate "is-water" is still true. Perhaps, a single H₂O-molecule is already too small to be itself water. Exactly where we draw the line should not matter at the moment. What is important is that we do not use the predicate "is-water" as though water were infinitely divisible into parts that are themselves water.

⁸⁰ See, for instance, Bunt (1979), pp.255-256; Roeper (1983), p.256; ter Meulen (1981), p.111; Landman (1991), p.312.

⁸¹ Notice that "is-a-part-of", here, cannot be read as the relativized "is-a-water-part-of". For the relativized notion of parthood commits us to minimal water-parts and this commitment is precisely what is under dispute. "Is-a-part-of", here, must be read as an unrelativized relation.

Since the thesis that water is infinitely divisible into parts that are themselves water seems so obviously false, why would anyone even wish to entertain it? As far as I can see, the motivations behind this claim are the following.

First of all, there are mass-predicates for which it would be difficult even to find an appropriate atom. In the case of "is-water", the H₂O-molecule certainly appears to be a good candidate. With respect to "is-furniture", we might consider chairs, tables, beds, and so forth, to be appropriate atoms. In the case of "is-gold", it could be individual gold-atoms. But what about "is-stew" and "is-mud"?⁸²

This worry is clearly justified. I am not sure what the smallest part of a given portion of stew would be, such that the mass-predicate "is-stew" still applies to it and to none of its proper parts. Furthermore, this is not something we might eventually find out by conducting studies on the molecular structure of stew. Moreover, there are even worse cases than that of "is-stew" and "is-mud". Consider the predicate "is-light". Our current views on the nature of light say (very roughly) that light is both continuous and discrete: continuous, in the sense that light can sometimes exhibit wave-like behavior; discrete, in the sense that it can sometimes exhibit particle-like behavior. "Is-light" is an example of a mass-predicate, which would seem wrong for our semantic theory to require that its extension consists of appropriate light-atoms (and sums thereof).

Secondly, there is a worry that the introduction of atoms into the semantics of mass-predicates would somehow transform mass-predicates into count-predicates. This seems to be what Landman has in mind in the following passage:

⁸² Abstract nouns, such as "music", "non-sense", etc., are, of course, even worse. However, abstract nouns pose a more general problem. Not only is it unclear what the atoms in the case of abstract nouns would be. It is also unclear, to what extent and how we are to think of parts of music, non-sense, etc. at all. And the definition of " Φ -atom" makes crucial use of the parthood-relation.

...[I]t is not clear that when we think about water and the parts of water, there are such minimal elements, i.e. that there are minimal parts of water. Now, of course, we know that there are such minimal parts in the world, the water molecules. But there is good reason to assume that these minimal water particles do not play any role in the semantic domain of water and its parts. Namely, assume that they do, i.e. assume that water is the set of sums of water molecules. Now take the water in my cup. We know that it contains a finite number of water molecules, hence it contains a finite number of atoms. Say the number is 10 million. Since the water in my cup is the sum of these 10 million atoms, we would be conceptually able to count the water in my cup, hence we should be able to interpret "There is 10 million water(s) in my cup". But, of course, we cannot. Water cannot be counted. We can measure how much water there is in my cup, we cannot count how much water there is.⁸³

The line of argument, here, seems to be roughly the following. (I am shifting, just for a moment, to a different example.) The singular count-predicate "is-a-man" is true of all and only whole individual men; these are the atoms in the case of "is-a-man". When "is-a-man" is true of something, the thing of which it is true is *a man*, *one of the world's men*. The extension of the singular count-predicate "is-a-man" is also such that cardinality questions are meaningful with respect to it. When we try to answer a question of the form "How many men...?", we would count how many of the relevant atoms, i.e. how many whole individual men, there are in a particular context. It therefore seems as though *any* predicate whose extension consists of atoms would have to be like "is-a-man" in this respect. The atoms in the extension of any predicate Φ would be such that they each are *a Φ* , *one of the world's Φ s*. *Any* predicate whose extension consists of atoms should allow cardinality questions. For atoms are precisely the countable "units" which are needed in order to make cardinality questions well-formed. What we are to conclude from this, according to Landman, is that the

⁸³ Landman (1991), pp.312-313.

H₂O-molecules (which, *as a matter of fact*, we know to be the minimal parts of water) somehow "do not play any role in the semantic domain of water and its parts".⁸⁴

But Landman's line of argument is clearly misguided. To say that the extension of some mass-predicates consists of atoms (and sums thereof) in no way transform them into count-predicates. Suppose the atoms in the case of "is-water" are the individual H₂O-molecules. It is still the case that the predicate "is-water" is true of something *x* just in case *x* is water. Only now we know that the extension of "is-water" consists of H₂O-molecules, as its water-atoms. We can therefore draw the following inference. Since the predicate "is-water" is true of *x*, *x* must either itself be an individual H₂O-molecule or the sum of *n* H₂O-molecules. We can certainly count the number of H₂O-molecules contained in *x*. If *x* is an individual H₂O-molecule, then the number of H₂O-molecules contained in *x* is one. If, on the other hand, *x* is the sum of *n* H₂O-molecules, then the number of H₂O-molecules contained in *x* is *n*. But now we have counted the number of H₂O-molecules contained in *x*. We still have not counted *x*. *x* is just water. To say that the extension of the predicate "is-water" consists of H₂O-molecules, as its atoms, does not make cardinality questions of the form "How many water...?" well-formed.

The mass-predicate "is-water" would not be transformed into the singular count-predicate "is-a-water", even if we now decide to call a single H₂O-molecule *a* water, *one of*

⁸⁴ Although I do not claim to understand what Landman could have in mind by the "semantic domain of water and its parts", this sort of view seems to be relatively widespread among the model-theoretic community. Consider, for instance, the following passage from Lonning (1987):

...[O]ur interest lies in the natural language itself, not in the world it describes. This means that the models we build are not necessarily "true" models of the physical world, but means to understand the language, in particular, to give valid forms to intuitively true sentences and inferences. [p.7]

the world's waters. All this would mean is that the noun "water" has now acquired a new usage, in which it has a count-occurrence. "Water", in the way it is used now, can already have certain kinds of count-occurrences. We already use "water" in this way, when we speak of kinds of water or glasses of water. The decision to call an H₂O-molecule "a water" would simply add one more kind of count-occurrence to the count-occurrences "water" can already standardly have. In these count-occurrences, the noun "water" would of course function as part of the singular count-predicate "is-a-water". The extension of the singular count-predicate "is-a-water" also allows for how-many questions. We can count glasses of water, kinds of water and H₂O-molecules. But, again, counting these is not the same as counting water itself. To say that the extension of the mass-predicate consists of water-atoms, viz. H₂O-molecules, does not make water itself countable.

The final, and most important, motivation behind the claim that the extension of mass-predicates cannot consist of atoms and sums thereof is this. Homogeneity is supposed to be a *semantic* property. It is somehow part of the *meaning* of "water" that it is infinitely divisible into water-parts. But the fact that water consists of H₂O-molecules intuitively does not strike us as a *semantic* fact. In other words, the sentence "Water consists of H₂O-molecules" does not strike us as *analytic*: it does not seem to be *true in virtue of meaning* alone. (If, that is, there is such a thing as "truth in virtue of meaning"; but even if there is not, the sentence "Water consists of H₂O-molecules" still seems very different from, say, "Bachelors are unmarried".) It seems conceivable that the Ancient Greek term denoting water to the Ancient Greeks meant the same as, or at least something reasonably close to, what our term for water means to us, even though the Greeks did not know that water consisted of H₂O-molecules.

The fact that water consists of H₂O-molecules seems to be a straightforward *empirical* fact. Scientists discovered this to be the case only very recently. And, here, I mean

"empirical" not so much in the sense of "contingent". Following Kripke's and Putnam's work on natural kind terms, we are supposed to have the intuition that it is *metaphysically necessary* that water consists of H₂O-molecules.⁸⁵ Thus, "empirical", here, must be taken in the sense of *a posteriori*. The fact that water turned out to consist of H₂O-molecules certainly appears to be an a posteriori fact. It cannot be deduced from the meaning of the term "water" alone.

In contrast, the fact that the extension of the singular count-predicate "is-a-man" consists of whole individual men like Socrates does not seem to require any empirical knowledge concerning the molecular substructure of humans. We did not need to conduct experiments to find out what the atoms in the case of "is-a-man" are. The fact that whole individual men like Socrates are the atoms in the case of "is-a-man" seems to come somehow with the meaning of the predicate itself.

Thus, there does appear to be a real difference between the claim that the extension of the mass-predicate "is-water" consists of water-atoms (and sums thereof) and the claim that the extension of the singular count-predicate "is-a-man" consists of whole individual men like Socrates. As a result, one might feel that our semantic theory should not commit us to an atomistic view of the world, according to which the extension of "is-water" must consist of water-atoms (and sums thereof); and similarly for all mass-predicates.

Suppose, then, we agree that our semantic theory should not legislate that the extension of mass-predicates consists of appropriate atoms (and sums thereof). But it seems equally wrong for a semantic theory to commit us to an atomless universe, according to which the extension of "is-water" cannot consist of water-atoms. Our semantic theory, it seems, should not make the false prediction that *every* part of water (in some standard, non-relativized sense of parthood) is itself water. For if it did, it would generate a rather strange result:

⁸⁵ See, especially, Kripke (1972), Putnam (1975).

analytic truths that are, as a matter of empirical fact, false. A semantic theory which commits us to the claim that the extension of the mass-predicate "is-water" cannot consist of water-atoms would predict that the sentence "Every part of something that is water is itself water" is true in virtue of meaning. But it is false, as a matter of fact, that every part of something that is water is itself water. So, the sentence "Every part of something that is water is itself water", it seems, should definitely not be classified as an analytic truth.⁸⁶

The right position seems to be one, according to which our semantic theory commits us to neither an atomistic nor an atomless universe. We have to allow for such mass-predicates as "is-water", whose extension, as a matter of fact, does seem to consist of water-atoms (and sums thereof). But we must also allow for such mass-predicates as "is-light", which apply to things that behave in both continuous and discrete ways. As a result, our semantic theory should neither predict that the extension of "is-water" consists of water-atoms (and sums thereof) nor that the extension of "is-water" does not consist of water-atoms (and sums thereof). A semantic theory should remain agnostic on this issue.

But if this is right, then what should we conclude about the status of distributivity? The milder conclusion would be to say that distributivity, in some suitable formulation of it, *is* a property of all or most mass-predicates, only not a *semantic* property. To know whether a predicate Φ is distributive seems to require knowledge concerning the molecular substructure of those entities to which Φ applies. But such knowledge is empirical; we do not immediately acquire it when we learn the meaning of the term "water".

⁸⁶ Or, alternatively, suppose we hold on to the claim that the principle "Every part of something that is water is itself water"; then by discovering that water consists of H₂O-molecules we have discovered that there is no such thing as water. But this consequence is equally unwelcome.

The more radical conclusion would be to reject distributivity outright as a property of mass-predicates, semantic or otherwise. This view seems to me the most plausible, especially considering examples like "succotash", "gravel", "sand" and "furniture". As long as we stick with "water" the view that, as far as matters of meaning are concerned, water is infinitely divisible into water-parts gains some credence from the fact that we cannot actually *see* the individual H₂O-molecules. It took us centuries to discover their presence, and so we might want to grant that they do not really enter into our ordinary water-talk. However, we *can* see the corn and the beans in succotash, the little stones that make up gravel, the individual grains of sand, and the tables and chairs that make up furniture. Their presence did not need to be discovered by scientists and can easily enter into our ordinary talk. Given these considerations, I would like to conclude that distributivity is not a semantic property of mass-predicates. Of course, there is still the somewhat lame property that mass-predicates are true of some, and perhaps even many, of the parts of something to which they apply. But this is not an interesting generalization, since we came across singular count-predicates, such as "is-a-cloud", which are also true of some, perhaps even many, of the parts of something to which they apply.

But what are we conclude about the status of cumulativity? If distributivity is not a semantic property of mass-predicates, what about cumulativity? We commonly think of parts and sums as going hand in hand. Thus, it might seem a little strange to say that cumulativity *is* a semantic property, while distributivity is not. But, off hand, I can see no reason for doing so. We did not need to conduct scientific experiments to know that the sum of two quantities of water is itself still water. There really is something empirical about knowing which

predicates are distributive, whereas there is nothing empirical about knowing which predicates are cumulative.⁸⁷

⁸⁷ It has been pointed out to me that there is an interesting similarity here between distributivity, on the one hand, and the notions of vagueness and truth, on the other. We have seen that the principle "Every part of something that is water is itself water" holds in very many cases, but ultimately causes trouble if we universally instantiate too many times. Distributivity is, in this respect, reminiscent of the induction premise in Sorites-style paradoxes, according to which removing a grain will still leave us a heap. As in the case of distributivity, this principle also holds in very many cases, but ultimately gets us into trouble, when applied too many times. In the case of truth, the similarity concerns instances of schema T: it is certainly the case that very many instances of schema T hold; but, again, if we try to hold on to all instances of schema T, we end up with trouble.

There is one kind of position concerning vagueness, according to which the induction premise in the Sorites, despite its troubling consequences, is part of the meaning of our ordinary concept "heap" (although it is not part of some revised concept "heap"). The corresponding position in the case of truth has it that it is part of the meaning of our ordinary concept of truth that all instances of schema T hold (although it is not part of some revised concept of truth). Given the similarity between distributivity, vagueness and truth, there is a similar position with respect to the part/whole relation. According to this view, it would be part of the meaning of our ordinary part/whole relation that every part of something that is water is itself water, even though we now know, as a matter of empirical fact, that this is not true indefinitely. Such a view, in all three cases, is committed to there being two very different projects of inquiry: one of a more descriptive nature and one of a more normative nature. The descriptive project studies our ordinary concepts; the normative one refines our ordinary concepts by means of considerations raised in science, logic and the like. As of yet, I have not made up my mind about this kind of view, but it certainly deserves further attention. Moreover, regardless of what we make of the view sketched above, the fact that there is this similarity between distributivity, vagueness and truth is itself of great interest.

V. CONCLUSION

In conclusion, let me review the main points I have covered and give some indication of where this leaves us. I began with the observation that there is an intuitive distinction between the role of "hair" in (1.a) & (1.c):

- (1) a. There is a hair in my soup.
- c. There is hair in my soup.

According to the view taken here, (1.a) & (1.c) contain *one and the same* noun, in two different *occurrences*: in (1.a), "hair" has a singular count-occurrence; in (1.c), a mass-occurrence. Occurrences of nouns, as briefly sketched in chapter III., are to be individuated syntactically (for the most part), according to the particular grammatical context in which they are found. This constitutes my answer to the Problem of Classification (Project (i)):

(i) CLASSIFICATION:

- * Which occurrences of nouns are mass-occurrences?
- * Which occurrences of nouns are count-occurrences?
- * How are mass-occurrences of nouns marked off from count-occurrences of nouns?

The syntactic rules of classification outlined in chapter III. only apply to nouns and noun-phrases. But, among nouns and noun-phrases, they apply to concrete ones, such as "apple" and "table", and abstract ones, such as "music" and "proof", alike. It would be interesting to see, whether this is a weakness in my account or a merit. Should "music" and "proof" really be treated in the same way as "apple" and "table", or should we amend our criteria in some way and treat abstract nouns separately? Moreover, it would also be of some interest to see how (if at all) the view developed here can be extended to other syntactic categories. For instance, it is widely believed that a mass/count distinction can also be drawn

among adjectives. "Red", when applied to "ink" means something like "red all the way through"; when applied to "house", it means something like "red only on the outside". Perhaps, this means that "red" has both mass-occurrences and count-occurrences, much like "carrot"?

It is by no means universally agreed that the mass/count distinction is to be drawn among syntactically individuated occurrences of nouns. The rival view --or one of them, at any rate--, which I have called the *lexical-ambiguity view*, has it that (1.a) & (1.c) contain two different lexical items: the *mass-noun* "hair" and the *count-noun* "hair"; the two only happen to be spelled the same. This view strikes me as less plausible, because it has a harder time accounting for the following two observations. First, we find that language displays an impressive generative power: it is very easy to introduce new uses for old nouns. For instance, "snow", under current usage, cannot have the following kind of count-occurrence:

(37) Boston has not had many snows lately.

However, even though (37) sounds somewhat non-standard, it is easily interpretable and there is no reason why "snow" should not acquire this kind of use, if we found it convenient to talk in this way.

Secondly, we feel that there is a systematic relation between the two occurrences of "hair" in (1.a) & (1.c), as indeed between mass and count-occurrences of any noun. The view advocated here tries to capture this relation by the fact that (1.a) & (1.c) contain occurrences of *one and the same* noun. These occurrences, as it turned out in section IV.4, are systematically related through a one-way entailment relation, according to which everything that is *a* hair is also hair, but not conversely. Thus, in terms of language-acquisition, I would argue that a speaker who knows how to use "hair" in its count-occurrences does not acquire a

new *word*, when he learns how to use it in its mass-occurrences. Rather, all we need is some *general rule* that tells us how to move from count-occurrences to mass-occurrences of one and the same noun and conversely.

Given a sufficiently sophisticated theory of the lexicon, it is conceivable that the lexical-ambiguity view could also capture this systematic relationship in some way. For instance, suppose we have two lexical entries under "to eat": the transitive verb "to eat" and the intransitive verb "to eat", as in

- (83) a. John ate.
- b. John ate his dinner.

Surely, any viable theory of the lexicon must be able to capture the relation between the two verbs "to eat" in (83.a) & (83.b) (e.g. it follows from John having eaten his dinner that he has eaten). Perhaps, the relation between "a hair" and "hair" could be accounted for in similar ways. In this case, the lexical-ambiguity view would gain some plausibility. However, it would also cease to be a genuine lexical-*ambiguity* view: if the two lexical items "hair" are systematically related, much like the two verbs "to eat", the phonetic shape "hair" is no longer ambiguous in the same way in which, say, "bank" is. For in the case of "bank", it seems right to say that it is a mere accident that the two nouns "bank" as in "financial institution" and "bank" as in "river-bank" happen to be spelled the same. But it is no mere accident that "hair" in (1.a) & (1.c) is spelled the same. (This observation is strongly supported by cross-linguistic data.)

The second problem I discussed was the Problem of Logical Form (Project (ii)), in particular as pertaining to nouns in their mass-occurrences:

- (ii) **LOGICAL FORM**:
What is the logical form of sentences containing mass-occurrences of nouns?

We came across the following three general strategies, in the literature:

THE NAME-VIEW:

When a noun has a mass-occurrence, it always functions semantically as a name.

THE PREDICATE-VIEW:

When a noun has a mass-occurrence, it always functions semantically as part of a predicate.

THE MIXED VIEW:

When a noun has a mass-occurrence, it functions semantically either as a name or as part of a predicate.

In chapter II., I discussed a version of each of these views: Quine (1960) as a representative of both the name-view and the mixed view; Parsons (1970) as another version of the name-view; and Burge (1972) as an advocate of the predicate-view.

All three proposals give rise to serious difficulties. The problem with the name-view is that it crucially relies on the availability of reference-dividing relations (such as "is-a-quantity-of") which relate individual instances of, say, the totality of the world's water with the totality itself. Such a reference-dividing relation cannot be mere parthood, since not all parts of the world's water are themselves water: the individual hydrogen atoms, for instance, are not. Thus, it must be parthood plus something else. The something else is there to make sure that all those parts that are not water are excluded from the extension of the relation. But this seems like mass-predication in disguise: the doctored-up reference-dividing relation applies to all those things that are part of the totality of the world's water and are themselves water.

This objection is raised in Burge (1972) and applies to both Quine's and Parsons' version of the name-view. More strongly, it seems to me that Burge's objection would apply to *any* name-view. For not all sentences are about the totality of the world's such-and-such.

In fact, only a very special class of sentences is: generic sentences. These are sentences of the following form:

- (56) a. Snow is white.
b. Water is wet.
c. Gold is valuable.

Generic sentences, at least at first glance, is where the name-view works the best. For, according to the name-view, these sentences are of simple subject/predicate form: "snow" functions semantically as a name, referring to the totality of the world's snow; the predicate "is-white" applies directly to the big object. However, generic sentences are a special class. All other sentences single out bits and pieces of the totality of the world's such-and-such. And to account for these kinds of sentences, the name-view needs a reference-dividing relation of some sort.

The problem with Burge's version of the predicate-view is that it dismisses the intuitive distinction between mass-occurrences and count-occurrences of nouns entirely. Burge analyzes all mass-occurrences of nouns as count-occurrences in disguise. This, I think, is mainly due to a widespread but faulty assumption concerning (substantival) predication: that all proper (substantival) predicates have a "built in mode of dividing reference" (and those that do not are somehow defective and ought to be repaired). "Built in mode of dividing reference" (a la Quine) is understood as a *count*-way of dividing one's reference. A competent speaker, according to Quine, who has mastered the scheme of divided reference can tell, not only "how much of what goes on is apple", but also "how much counts as *an* apple and how much as another".⁸⁸ However, it is hard to see why it should be intrinsic to the notion of a

⁸⁸ Word & Object, p.91.

predicate that it applies to countable units, such as individual apples. In fact, the view advocated here is a version of the predicate-view which rejects this assumption.

The mixed view fails to capture certain kinds of inferences, such as

(11) Snow is white.
This stuff is snow.

This stuff is white.

Generally speaking, the inferences with which the mixed view has difficulties are ones that contain both mass-occurrences and count-occurrences of one and the same noun. Since the mixed view assigns two completely different semantic roles to these two occurrences, it cannot capture the fact that we are dealing with one and the same expression. But there is evidently some common semantic core shared by the mass-occurrence of "snow" in the first premise and its count-occurrence in the second premise, which allows us to make the inference in the first place. The mixed view loses this common semantic core.

My own proposal in response to the Problem of Logical Form is a version of the predicate-view, but one that is different from Burge's. I reject the Quinean assumption connecting predication with countable units and suggest instead that nouns in their mass-occurrences function semantically as predicates, much like nouns in their count-occurrences. Only, nouns in their mass-occurrences are analyzed into *mass-predicates*, predicates of the form 'is-N'; whereas nouns in their count-occurrences are said to play the semantic role of *count-predicates*, predicates of the form 'is-an-N'. There are thus two (irreducible) kinds of predicates: mass-predicates and count-predicates. The difference in truth-conditions between the two is that mass-predicates, such as "is-hair", apply to something just in case it is hair, while count-predicates, such as "is-a-hair", apply to something just in case it is one whole individual hair, as opposed to hair-parts and hair-sums.

Given the mystery traditionally surrounding mass-predicates, there is, I think, some more interesting work to be done, in order to make us feel more comfortable with this new creature, the mass-predicate. What exactly does it take for a speaker to understand and use mass-predicates? How do these capacities compare and contrast to what is involved in the use of count-predicates? Of course, on my view there is nothing mysterious about mass-predicates. Still, given the long tradition in which everything was cast in terms of count-predicates, it might be worth dispelling any possible misperceptions.

Mass-predicates and count-predicates, on the view advocated here, have something in common: they are both predicates. That is, they are both related to their extension in the same way: they are *true of* whatever falls into their extension. And it is my conjecture that the relation "is-true-of" is the same relation in both cases.

They are also related in a certain way, through a one-way entailment relation going from count to mass. The entailment relation says that everything of which the count-predicate 'is-an-N' is true is also such that the mass-predicate 'is-N' is true of it, e.g. everything that is *an apple* is also *apple*. The same does not hold conversely: not everything that is *apple* is also *an apple*. This entailment relation supports my claim (or, at least, goes part of the way) that it is *one and the same* noun N playing two different semantic roles.

To say how mass-predicates and count-predicates differ from each other turned out to be quite tricky. I came up with two differences. First, there is a connection between count-predicates and counting. Roughly speaking, the connection is as follows. When we wish to associate, say, the world's hair with cardinal number (as this would be done in certain kinds of questions beginning with the words "how many"), we need to speak of it in terms of individual hairs, the things of which the singular count-predicate "is-a-hair" is true. If, on the other hand, we are interested in amounts of hair (as expressed, for instance, in certain

questions beginning with the words "how much"), we need to speak of the world's hair in terms of those things of which the mass-predicate "is-hair" is true.

It is, I think, an interesting metaphysical consequence of the view proposed here that the way we speak --just plain hair versus individual hairs-- need not reflect any difference in the kind of thing we are talking about (though it could). We could be talking about the very same thing, the hair in my soup, in either a mass-way or a count-way, whichever one is more handy at the time. (I speculated that this view of the world leaves us somewhere between Frege and Geach; but this is certainly a place where there is a lot more room for further study). There is no neat line-up between the mass/count distinction and the metaphysical distinction between a thing and some stuff. A two-sorted ontology would thus be wrongheaded. On the other hand, I also do not mean to suggest that there are no interesting metaphysical distinctions to be drawn here. For instance, we might come up with metaphysical principles which, for whatever reasons (maybe having to do with parthood or with conditions of identity and individuation), group clouds together with cotton and, perhaps, carrots with asparagus. Nothing I said is meant to rule out endeavours of this kind. My point is merely that such principles should be expected to cut across linguistic boundaries: "cloud" standardly has only count-occurrences; "carrot" has both; "cotton" and "asparagus" have mostly mass-occurrences.

So much for the first difference between mass-predicates and count-predicates. The second difference has to do with sums and parts. It first looked as though the second difference was going to be that all mass-predicates, and no count-predicates, are homogeneous. A predicate is homogeneous just in case, first, it is true of all *parts* of something of which it is true (distributivity) and, second, it is true of all *sums* of something of which it is true (cumulativity). However, upon closer scrutiny, we found that at least distributivity had to be

rejected. We now know that water is not infinitely divisible into water-parts: individual hydrogen-atoms, for instance, are not themselves water. And this fact cannot simply be ignored and assigned to some other domain, where it would be irrelevant for the analysis of natural language (as this is sometimes done by writers working within the model-theoretic perspective). Hence, I suggest, we should not make it part of the meaning of "water" that water *is* infinitely divisible into water-parts. On the other hand, it should *also* not be part of the meaning of "water" that water consists of H₂O-molecules: even though metaphysically necessary, this was a fairly recent discovery. But this is another point where the view proposed here could profit from further study, particularly from work on natural kind terms and the kind of modalities involved here.

The essence of the view presented here is that mass-predicates of the form 'is-N' are in no way defective or mysterious or in need of such relations as "is-a-quantity-of", "is-a-bundel-of", "is-a-tuft-of", "is-a-puddle-of". It is true that it is always *possible* to paraphrase mass-predicates in this way. And sometimes, depending on the specificity of the chosen reference-dividing relation, we will have revealed more information in the paraphrase than what is contained in the original sentence. To illustrate, "This is a tuft of hair" is certainly more informative than "This is hair". And in all circumstances in which "This is hair" is uttered, some paraphrase of the form "This is a mound of hair", "This is a tuft of hair", and so on, will be appropriate. However, it is my view that no such paraphrase is *necessary*. The sentence "This is hair" is perfectly intelligible in its own right. As Helen Cartwright has pointed out a long time ago in response to Strawson, there is no need to "[...] wait until we

know whether we are talking of *veins, pieces* or *quantities* of gold or of *falls, drifts* or *expanses* of snow". There is nothing wrong with talk of just gold and snow.⁸⁹

⁸⁹ See Cartwright (1970) and subsequent work. The quote comes from Strawson (1953/54), p.242.

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